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# EUPHORBIA SPECIES FROM THE FLORA ZAMBESIACA AREA: IX

L. C. Leach

## ABSTRACT

The taxonomic and nomenclatural position in respect of *Euphorbia angularis* Kl. and *E. cooperi* N.E. Br. ex Berger is discussed, as well as their relationship with such species as *E. nyikae* Pax and *E. grandicornis* Goeb. ex N.E. Br.

An emended description of *E. angularis* is given; one new species from Moçambique, *E. halipedicola* and a new variety, *E. cooperi* var. *calidicola*, are described and *E. ussanguensis* N.E. Br. is reduced to varietal status in *E. cooperi*.

*E. breviarticulata* Pax is reinstated as a species distinct from *E. grandicornis*, of which the new subsp. *sejuncta* is described, and some tentative suggestions made concerning the possible identities of some of the other related East African species.

A key is provided for the taxa dealt with, together with a map showing their distribution as presently known.

## UITTREKSEL

EUPHORBIA SOORTE VAN DIE FLORA ZAMBESIACA GEBIED: IX.—Die taksonomie en nomenklatuur van *Euphorbia angularis* Kl. en *E. cooperi* N.E.Br. ex Berger word bespreek sowel as hulle verwantskap met soorte soos *E. nyikae* Pax en *E. grandicornis* Goeb. ex N.E.Br.

'n Verbeterde beskrywing van *E. angularis* word gegee; 'n nuwe soort uit Mosambiek, *E. halipedicola*, en 'n nuwe variëteit, *E. cooperi* var. *calidicola*, word beskryf en *E. ussanguensis* N.E.Br. word as 'n variëteit van *E. cooperi* beskryf.

*E. breviarticulata* Pax word weer erken as 'n soort duidelik onderskeibaar van *E. grandicornis* waarvan 'n nuwe subsp. *sejuncta* beskryf word. Tentatiewe voorstelle oor die moontlike identiteit van sommige verwante Oos-Afrikaanse soorte word gemaak.

'n Sleutel vir die taksa bespreek word voorsien tesame met 'n kaart om hul bekende verspreiding aan te toon.

## INTRODUCTION

In this, the ninth in the series, the writer attempts to clarify the taxonomic nomenclatural position in respect of *Euphorbia angularis* Klotzsch and *E. cooperi* N.E. Brown ex Berger and their relationship with such species as *E. nyikae* Pax and *E. grandicornis* Goeb. ex N.E. Brown.

It was found that a large proportion of the type material of the species involved is, from one cause or another, non-existent, and that much of the herbarium material available is quite inadequate for any critical taxonomic study. Furthermore many of the original very brief descriptions, being not only vague and scarcely diagnostic but also often based on sterile specimens, are consequently of little assistance.

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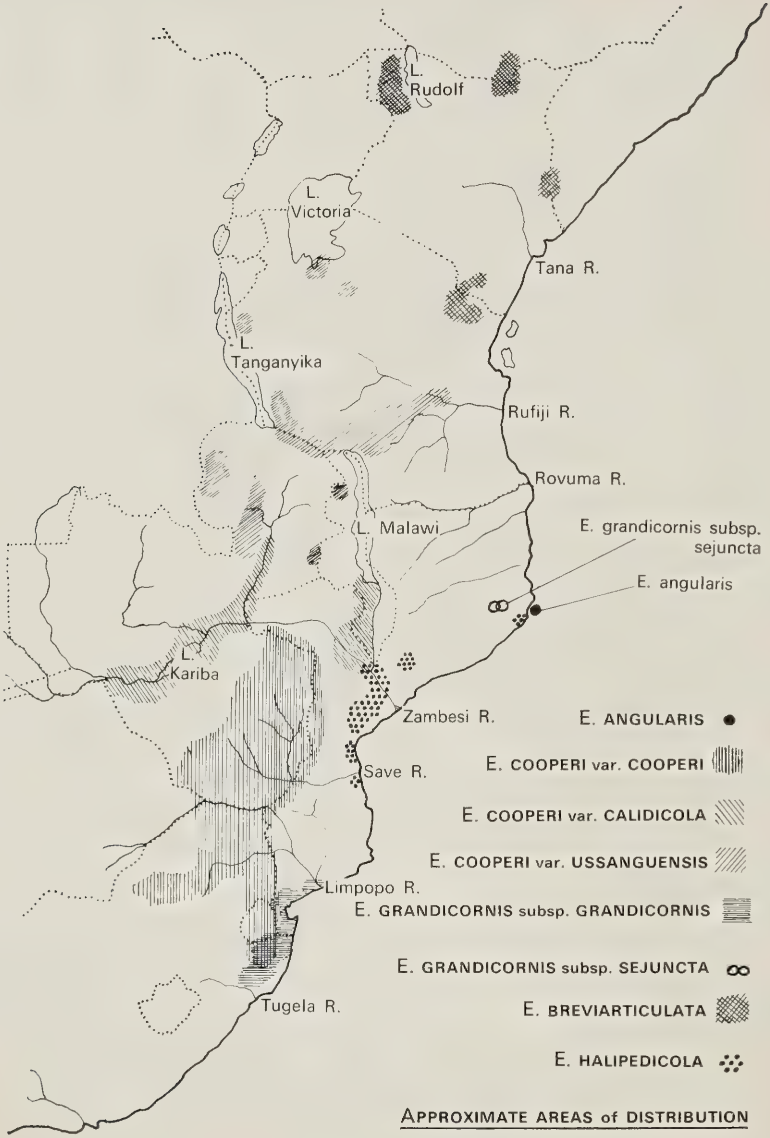
L. Rudolf
L. Victoria
Tana R.
L. Tanganyika
Rufiji R.
Rovuma R.
L. Malawi
E. grandicornis subsp. sejuncta
E. angularis
L. Kariba
Zambesi R.
Save R.
Limpopo R.
Tugela R.
E. ANGULARIS ●
E. COOPERI var. COOPERI
E. COOPERI var. CALIDICOLA
E. COOPERI var. USSANGUENSIS
E. GRANDICORNIS subsp. GRANDICORNIS
E. GRANDICORNIS subsp. SEJUNCTA ∞
E. BREVIARTICULATA
E. HALIPEDICOLA
APPROXIMATE AREAS of DISTRIBUTION

It therefore became apparent that any solution to the taxonomic problems involved must be sought in the field. Accordingly, as many as possible of the type localities (or regions), where these could be established, were visited. Herbarium specimens as well as live plants for further observation under cultivation were obtained from these and other localities, wherever members of the complex were found.

The conclusions drawn from a study of this material and of that already existing in various herbaria, as well as of the relevant literature are set out in the following notes.

Chronological list of the species discussed (nomenclatural synonymy excluded), with locality of original publication in respect of species for which this is not cited elsewhere.

*Euphorbia angularis* Klotzsch (1862)
,, *lemaireana* Boissier (1862)
,, *nyikae* Pax (1895)
,, *grandicornis* Goebel ex N.E. Brown (1897)
,, *bussei* Pax, in Engl. Bot. Jahrb. **33:** 286 (1903)
,, *breviarticulata* Pax (1904)
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,, *intercedens* Pax, in Engl. Bot. Jahrb. **34:** 75 (1904)
,, *cooperi* N.E. Brown ex Berger (1907)
,, *hubertii* Pax in Schles. Ges. Vaterl. Cult. **2:** 151 (1911).
,, *kibwezensis* N.E. Brown in Fl. Trop. Afr. **6,** 1: 586 (1912)
,, *ussanguensis* N.E. Brown (1912)

## KEY TO THE SPECIES DEALT WITH

Shrubs without or with a very much reduced main trunk
  Spines usually more than 2 cm long
    Inflorescence with up to 6 or more cymes randomly arranged and the central male cyathium usually deciduous; segments generally ± transversely oblong, ± twice as broad as long........................(5) *E. breviarticulata*
    Inflorescence with 1—3 cymes regularly transversely arranged, with the central male cyathium usually deciduous
      Segments 3—4-winged, subcircular or subrectangular or ± broadly ovate, generally ± as long as broad......(4a) *E. grandicornis* subsp. *grandicornis*

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FIG. 1.

Some of the apparent distributional discontinuities shewn in the map are thought probably to be due to inaccessible and difficult terrain with the consequent lack of collecting

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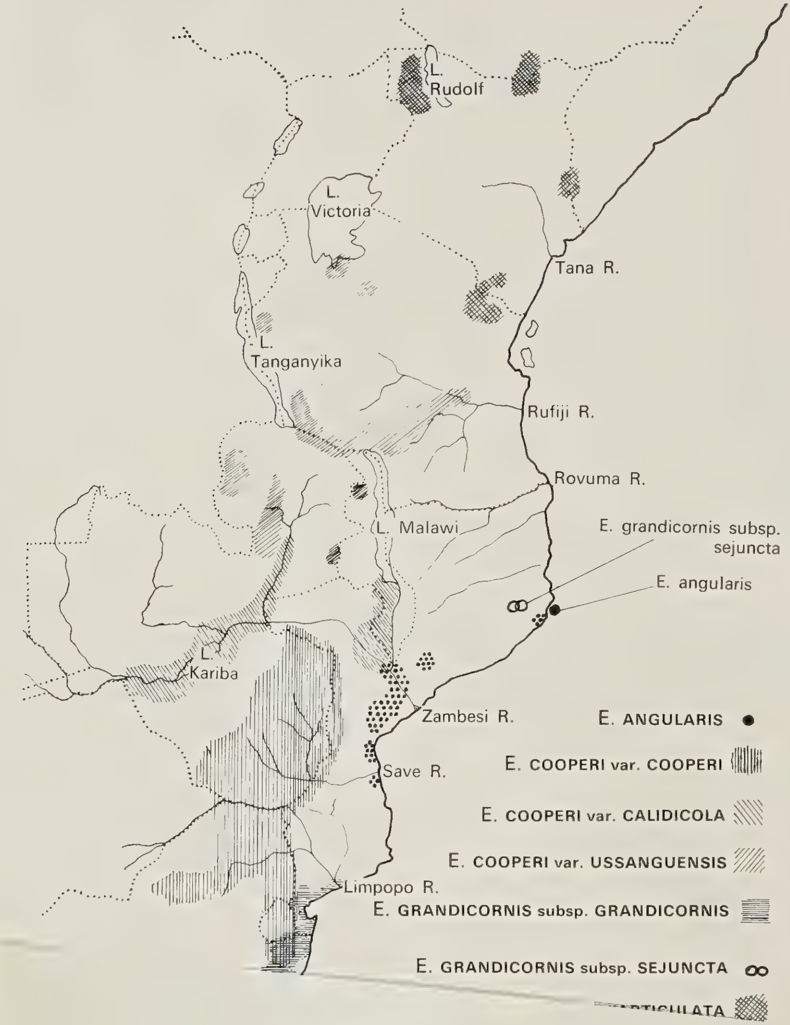
## ERRATUM

Journal of South African Botany, Vol. 36 Part 1: 13-52 (1970).
"Euphorbia species from the Flora Zambesiaca Area IX"

In the key on page 15 the "Inflorescence" clue leading to *Euphorbia grandicornis* should read:

Inflorescence with 1-3 cymes regularly transversely arranged, with the central male cyathium usually *persistent*.


L. Rudolf
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E. ANGULARIS ●
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E. COOPERI var. USSANGUENSIS
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RTICULATA

It therefore became apparent that any solution to the taxonomic problems involved must be sought in the field. Accordingly, as many as possible of the type localities (or regions), where these could be established, were visited. Herbarium specimens as well as live plants for further observation under cultivation were obtained from these and other localities, wherever members of the complex were found.

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## KEY TO THE SPECIES DEALT WITH

- Shrubs without or with a very much reduced main trunk
  - Spines usually more than 2 cm long
    - Inflorescence with up to 6 or more cymes randomly arranged and the central male cyathium usually deciduous; segments generally ± transversely oblong, ± twice as broad as long........................(5) *E. breviarticulata*
    - Inflorescence with 1—3 cymes regularly transversely arranged, with the central male cyathium usually deciduous
      - Segments 3—4-winged, subcircular or subrectangular or ± broadly ovate, generally ± as long as broad......(4a) *E. grandicornis* subsp. *grandicornis*

Fig. 1.

Some of the apparent distributional discontinuities shewn in the map are thought probably to be due to inaccessible and difficult terrain with the consequent lack of collecting, e.g. *E. cooperi* var. *calidicola* almost certainly occurs along the Zambesi between the Luangwa Riv. confluence and Tete, although there are no records. Similarly *E. halipedicola* is probably to be found on the coastal plain between the Zambesi and Lumbo. This latter species has also, in all probability, suffered from considerable habitat interference from "shifting agriculture" in that region.

Segments 2—3-winged, variable in shape from subcircular to narrowly oblong ........................................(4b) *E. grandicornis* subsp. *sejuncta*
Spines usually less than 1·5 cm long
Capsules relatively deeply lobed, 15—16 mm diam...............(1) *E. angularis*
Shrubs or small trees with a stout central trunk
Inflorescence with up to 6 or more cymes randomly arranged, with the central male cyathium usually deciduous; segments oblong, ± twice as long as broad, or the terminal segment ± broadly ovate........................(6) *E. halipedicola*
Inflorescence with 1—3 cymes regularly transversely arranged, with the central male cyathium persistent
Capsule clearly exserted from the involucre on a slightly curved, sub-obconic pedicel
Segments 4—6-winged, ± conic-ovate, wings 5—6 mm thick................ (3a) *E. cooperi* var. *cooperi*
Segments 3—4-winged, ovate to depressed ovate, wings ± 3 mm thick........ (3c) *E. cooperi* var. *calidicola*
Capsule barely exserted from the involucre on a short straight pedicel; segments very variable from subcircular to depressed obovate, 4—9-winged, wings 5—10 mm thick...........................(3b) *E. cooperi* var. *ussanguensis*

The main difficulty in constructing a workable key to the succulent members of the genus is the extent of the variation exhibited in their vegetative characters. When viewed in the field the distinctions may be clear enough, but it is often a very different matter to apply these to a single herbarium specimen (consisting sometimes of only a small portion of a wing), without recourse to the aid given

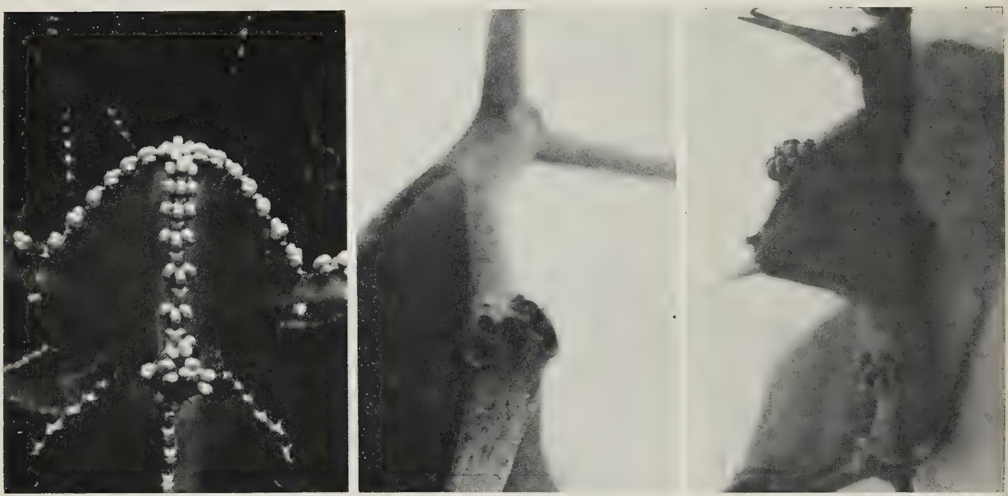


FIG. 2.

*E. cooperi* var. *cooperi Leach* 9458 shewing regular arrangement of 3 buds.

*E. breviarticulata Leach & Bayliss* 10241 shewing irregular arrangement of six peduncle scars.

E. sp., Dar-es-Salaam, *Leach & Brunton* 10165 shewing exceptionally large number of irregularly arranged buds.

to identification by locality. Undesirable though this course may be, it seems to be unavoidable in many instances, especially when the material is sterile.

One of the most useful characters lies in the arrangement of the inflorescence but this is difficult, indeed sometimes impossible, to determine from dried material. Even in this character there are occasional aberrations, e.g. in some individuals of *E. cooperi* var. *cooperi* occurring in the Zoutpansberg District of the Transvaal there is a tendency for the cymes to proliferate, additional buds sometimes developing above and below the normal row of three; under these conditions crowding sometimes results in a somewhat random arrangement of the peduncles, reminiscent of, but never actually as irregular as in *E. halipedicola* and other East African species, in which, incidentally, the cymes, when 2—3, may sometimes be more or less in transverse alignment. However such abnormalities are usually such a small proportion of the whole, that it is considered that they are scarcely likely seriously to affect the working of the key.

## EUPHORBIA ANGULARIS

*Euphorbia angularis* K1. being the oldest of the names presently under consideration, its relation to the taxonomy and nomenclature of the African succulent Euphorbias is such that it is thought necessary, at risk of some tediousness, to discuss in detail the more important points raised, both in literature and personal discussions, by other workers in this field, and their interpretations of Klotzsch's description.

It is not known whether this description was based on Peters's material or on a cultivated specimen (or possibly on a combination of these). That a plant was actually in cultivation at Berlin-Dahlem seems evident from Boissier's citation in DC. Prodromus: "Peters in h. Berol.!"; whether this was an imported plant or one grown from a cutting is not known (that it was raised from seed appears to be most unlikely as no mention is made of either fruits or seeds).

(1) **Euphorbia angularis** Klotzsch in Peters, Reise Mossamb. Bot.: 92 (1862).——Pax in Engl. Bot. Jahrb. **34:** 76 (1904) pro parte.——N.E. Br. in Fl. Trop. Afr. **6**,1: 584 (1912) pro parte.——White, Dyer & Sloane, Succ. Euphorb. **2:** 881 (1941) pro parte.——Jacobsen, Handb. Succ. Pl. **1:** 406 (1960) pro parte.

Type: Moçambique, Moçambique Distr., Goa Island, 15° 03′ S: 40° 27′ E, *Peters* s.n. (B†); Neotype: *Leach* 12361 (K; LISC; MO; PRE; SRGH; ZSS).

*Euphorbia abyssinica* var. *mozambicensis* Boiss. in DC Prodr. **15,** 2: 84 (1862). Type as above.

*Euphorbia cactus* sensu Schweinfurth in Bull. Herb. Boiss. Sér. I, **7,** App. 2: 321 (1899) pro parte.

Note: as *E. angularis* is known only from Goa Island, all the above "pro parte" references exclude everything except Peters's specimen from that locality and Boissier's synonym which is based on the same type.

*E. angularis* sensu Pax in Engl. Pflanzenw. Afr. (Engl. & Drude, Veg. der Erde) **9,** **1**: 443 et fig. 376 (1910), is *E. cooperi* N.E. Br. ex Berger, as is that of Eyles in Trans. Roy. Soc. S. Afr. **5**: 398 (1916).

*E. angularis* sensu Hutch., Botanist S. Afr.: 488 (1949) is, almost certainly, *E. candelabrum* Trém. ex Kotchy.

MOÇAMBIQUE. **N:** Moçambique Distr., Goa Is., st. 19.v.1961, *Leach & Rutherford-Smith* 10932 (K; PRE; SRGH); fl. & fr. 10.viii.1964, *Leach* 12361 (K; LISC; MO; PRE; SRGH; ZSS).

The "Cereus-like habit" of Klotzsch's German text, which appears to have given rise to some misconceptions, seems also to be implicit in the "Sectio cereiformes" of the Latin, but may perhaps, be accounted for by his having drawn up his description from a rooted cutting. This could also explain the 3-angular unbranched stem; such plants, grown from cuttings from various species, do sometimes adopt a similar unnatural habit. In any event it is thought that not too much importance should be attached to "Cereus-like" as the same expression has been applied, equally inappropriately, to other species, e.g. Pax in writing "Frutex ramosus, habitu *Cerei* sp. simulans" when describing *E. robecchii.* However, the Latin description also states "Fruticosa trunco cylindrico", and this exactly describes the plants extant on Goa Island today, albeit the trunk is very short and gnarled. Elongated prostrate main branches sometimes adopt a terminally erect habit, in such instances the main branch is, amidst the tangled mass of branches, easily mistaken for a partly prostrate 3-angled trunk; mature plants on Goa Island are, incidentally, about "the height of a man" or less.

It has been suggested that Klotzsch may have been describing *E. ingens* E. Mey. ex Boiss. but, apart from the fact that this species does not occur on the island, this is thought to be highly improbable in view of the "decurrent bosses" and "sessile inflorescence" of the description. Furthermore any 1·5—1·8 m high specimens of *E. ingens* known to the writer have been 4-angled and have not been known to flower until at a considerably greater age than would be indicated by this height.

Another suggestion is that Klotzsch's description indicates an interrupted margin to the wings or angles. Now although such an interpretation is possible there is nothing in either the German or Latin texts which would preclude the possibility of the margin's being continuous. N.E. Brown includes Kirk's Lower Zambesi plants (both with continuous margins) in his concept of *E. angularis* and places *E. lemaireana* (also with continuous margins) in synonymy; Pax included *Goetze* 1008 (later the type of the continuous margined *E. ussan-*

*guensis*) in *E. angularis*, and finally Schweinfurth, when writing up *E. cactus* Ehrenb. ex Boiss. placed *E. angularis* in synonymy. As these authors had all seen Peters's specimen it is thought that this can be accepted as conclusive evidence that its margins were, in fact, continuous.

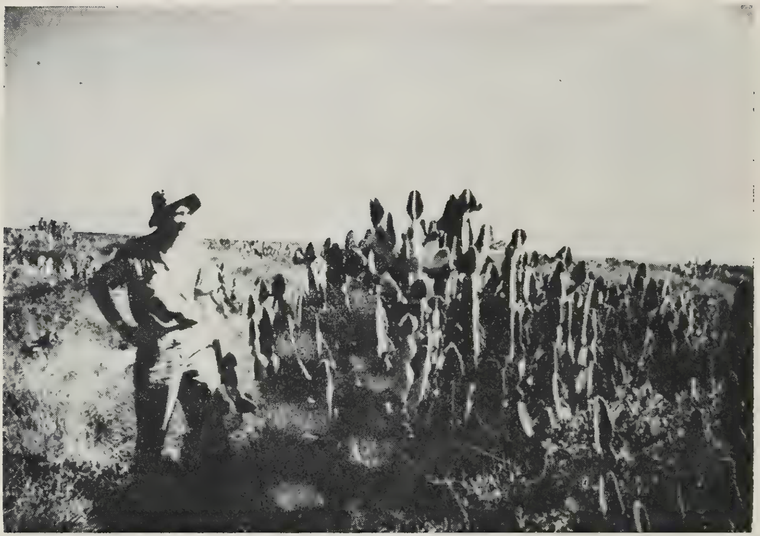
The cyathium referred to appears to be very young, at which stage "stigmas erect, not exceeding the male flowers" would quite normally, in inflorescences of this group, correspond to "erect glands" and "rounded sessile ovary" (N.E. Brown and White, Dyer & Sloane both describe the capsule but this appears to refer to Kirk's material from the mainland), the ovary of *E. angularis* is, moreover, quite globose until a relatively late stage in its development.

Klotzsch's own suggestion that his species might not belong in *Euphorbia* appears to stem from his misinterpretation of the male flowers (which are, in fact, quite normal for the genus) and the sessile ovary (which is also quite normal in immature cyathia, even in many species in which the capsule is ultimately far exserted). Furthermore when live plants and fresh material are examined then Klotzsch's description becomes more intelligible and there is certainly nothing contained therein which could be considered to exclude the Goa Island population.

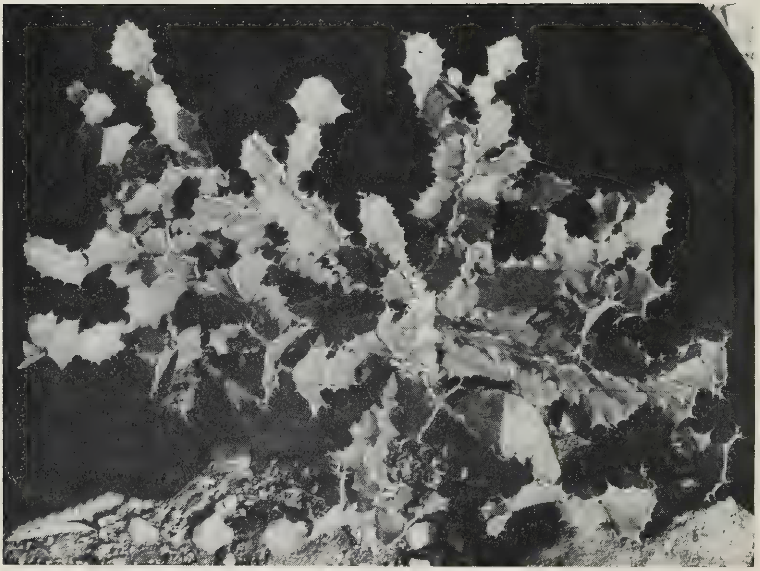
It is felt therefore, that on the available evidence, there is no reason to doubt that the identity of *E. angularis* is that of the plants existing today on Goa Island. This is a tiny coral islet (uninhabited other than by the lighthouse keeper and his assistants) lying at the entrance to Mossuril Bay on the N. Moçambique coast, on which the dominant vegetative feature is a succulent shrubby Euphorbia, namely, *E. angularis*. There are probably some hundreds of plants, some of which appear to be quite old (judging by the rate of growth of plants in cultivation) and there seems no reason to suspect that the population is materially different from that seen by Peters more than a century ago.

Morphologically *E. angularis* appears to be most closely related to *E. cooperi* complex and, to a lesser extent, to *E. grandicornis* and related plants of the Moçambique coastal plain. Its closest affinity appears to be with *E. cooperi* var. *calidicola* from which however, it differs in numerous characters, of which the more important are its entirely different habit; its larger involucre with larger, differently shaped glands, more coarsely fimbriate lobes and fewer male flowers, its larger more deeply lobed capsule which is subglobose when partially developed (that of its relative being trigonous at a similar stage of development) and is supported on a more or less cylindric pedicel which is quite different from the subobconic one of *E. cooperi* var. *calidicola*, while the styles are stouter and much enlarged at the apex as compared with those of its nearest relative; finally the seeds of *E. angularis* are larger and differently marked and the seedlings and juveniles of the two taxa are quite distinct.

Although the less closely related *E. grandicornis* is also of shrubby habit, *E.*



Mr. R. Rutherford-Smith examining a large plant at the type locality, Goa Island, Moçambique.



Cultivated plant shewing reduced trunk and early stage of elongated main branches.

FIG. 3. *Euphorbia angularis*

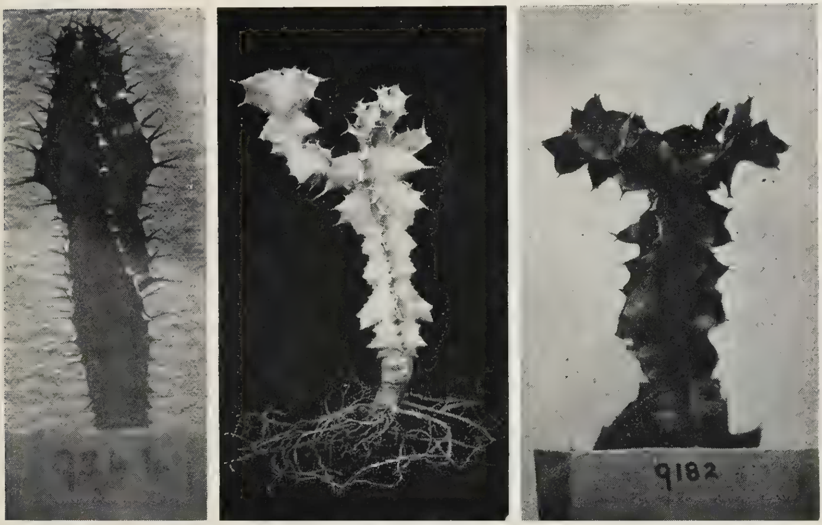
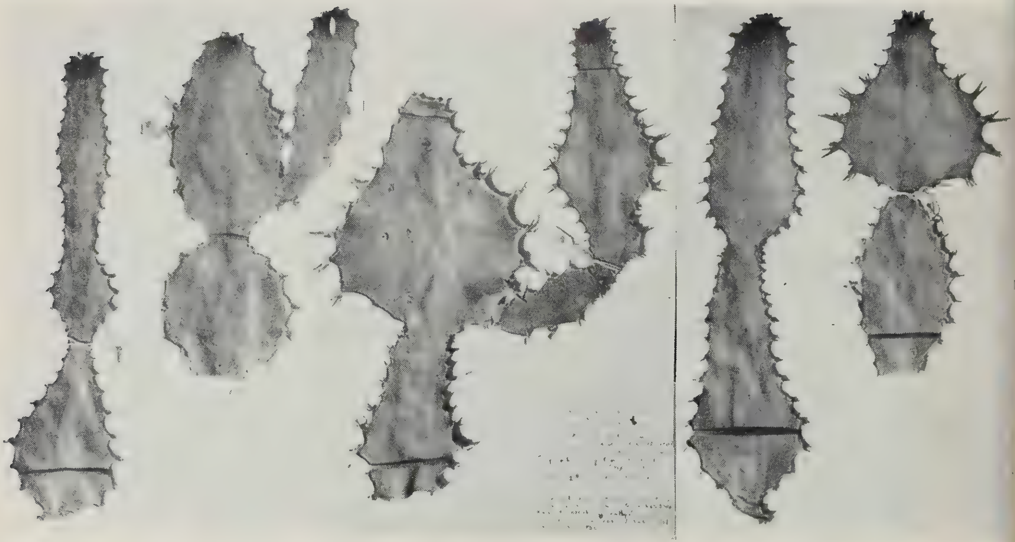


FIG. 4. Seedlings.

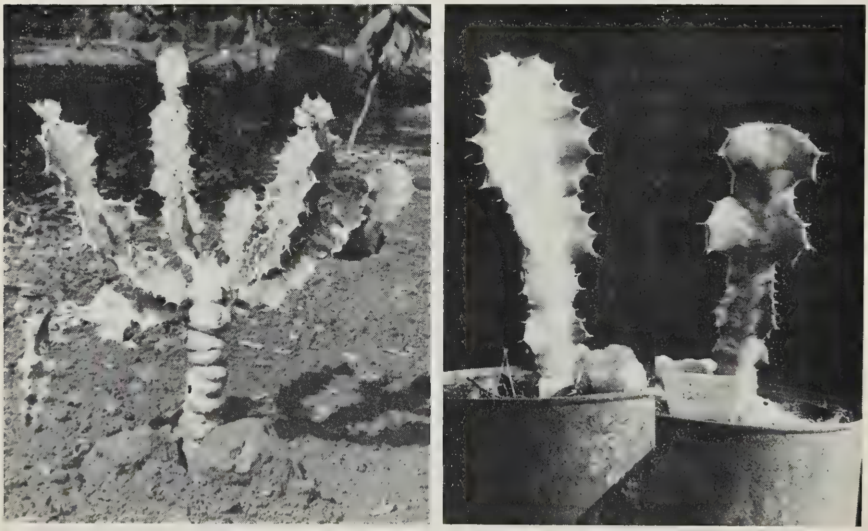
a. *E. cooperi* var. *cooperi* *Leach* 9244, Mtoko. b, *E. cooperi* var. calidicola *Leach* 11611, Wankie. c. *E. halipedicola Leach* 9182 Manica e Sofala.

*angularis* may be easily distinguished by its more variable and differently shaped, more stoutly winged segments with their less fiercely armed and less flexuosely undulate margins; while in the characters of its more compound inflorescence the larger cyathia and larger differently shaped fruits are most noticeable.

In spinescence Klotzsch's species most closely approaches *E. halipedicola* (newly described elsewhere in this paper) and it was probably this similarity which led N.E. Brown to include Kirk's two specimens from the lower Zambesi in his concept of *E. angularis* when comparing "the fragment in the Berlin Museum". However, in almost all other respects the two species are entirely different; particularly is this so in the arrangement of the inflorescence, which in *E. halipedicola* comprises a number (1—6) of randomly arranged, once forked cymes with relatively stalk-like peduncles and cyme branches and a deciduous initial cyathium, as opposed to the (1—3) regularly horizontally arranged, often several times forked cymes of *E. angularis*, with stump-like peduncles and cyme branches and a persistent initial male cyathium. In addition the two species may immediately be distinguished by the widely differing characteristics of their respective seedlings and the generally much longer, oblong segments of *E. halipedicola* as well as its stout trunk and taller stature.



Variation in segment shapes *Leach* & *Rutherford-Smith* 10932 (SRGH).



Typical young plant, estimated 15 years old. The trunk has not grown beyond this point.

Typical seedlings, ± 4 years old.

FIG. 5. *Euphorbia angularis*.

*Plant:* a densely branched and rebranched, glabrous, spreading shrub, often with a diameter 2—3 times its height, up to ± 2 m high, with a much reduced trunk. *Trunk* initially 3-angled, soon becoming 4-angled subcylindric, usually much gnarled and distorted. *Branches* spreading, often decumbent with the apical portion ascending; much branched and rebranched, with the secondary branches and branchlets arising from the margins, usually towards the base of the segments; 3—4, usually 3-angled or winged (branchlets 3-angled), sometimes scarcely winged, then with the faces flat or only slightly concave, constricted into segments of varying shape and size with a stout solid central core which is more or less angular in cross-section. *Segments* oblong, elliptic, ovate or sometimes more or less circular, generally ± 10—15 cm long × 7—12 cm broad; the more or less even or sinuate-toothed angles are provided with a continuous, horny, brown (becoming whitish grey) margin, usually ± 2·5 mm broad, widening up to 5 mm at the flowering eye and slightly less at the spine pairs. *Spines* in spreading, diverging pairs, longest at the widest part of the segments, up to ± 10 mm long, becoming much reduced towards the constrictions, generally c 10—25 mm apart along the angles. *Leaves* recurved, broadly ovate, acute, truncate at the base, c 1·5 mm long, soon deciduous, leaving a rather inconspicuous, transverse, narrowly reniform or depressed obovate scar with a pair of prickles (usually hooked) on either side. *Inflorescence* cymose, glabrous; cymes 1—3, horizontally arranged, each with 3 cyathia, often with secondary and tertiary branching and a correspondingly larger number of cyathia; flowering eye situated close to the lower of adjacent spine pairs or up to one third the distance between them above the lower pair, usually armed with a pair of straight or hooked spines, 1—3 mm long (occasionally with one or more additional small spines), often with several prickles. *Peduncle* bibracteate, very short and stout, 1—3 mm long × c 5—6 mm in its greater diam.; bracts usually split and deteriorated, c 8 mm broad × 3 mm long. *Cymes* with the three cyathia arranged in a plane parallel with the axis of the branch; the initial central cyathium male, persistent; the primary and subsequent lateral cyathia are borne on cyme branches similar to but usually somewhat longer than the associated peduncle; frequently with secondary and tertiary laterals; some cyathia of such compound cymes abort while others appear to delay their development so that it is possible to find cyathia at various stages of development, even to the extent of ripe fruits and buds occupying the same cyme branch. *Bracts* more or less semi-circular or somewhat lunate, c 8 mm wide × 3 mm long, with a minutely denticulate margin, often split as subsequent laterals develop. *Involucre* glabrous, cup-shaped, c 9 mm diam. × 4 mm long: glands 5, spreading, entire, more or less transversely elliptic, slightly shallowly concave, minutely tuberculate-rugulose, sometimes with a slightly raised smooth outer margin, yellow, 4·5—7 mm × 2·25—3 mm; lobes fimbriate toothed, subquadrate: 1·75—2 mm wide;

fimbria relatively rather coarse (± 12). *Male flowers* 35—50, with numerous filiform-fimbriate bracteoles, arranged in 5 bracteate fascicles; bracts deeply lacerate fimbriate; *pedicels* up to 4·5 mm long; *filaments* c 1·75 mm long. *Ovary* somewhat obovoid, seated on a rudimentary ± pentagonal perianth; ovule suspended under a relatively long, somewhat 2-lobed fleshy obturator; partially developed capsule 3-lobed, subglobose with rather prominent obtuse ribs down the angles of the lobes, partially exserted from the involucre. *Styles* stout, 3·5—5 mm long, free almost to the base or united into a column for up to two thirds their length, the free portions spreading recurved, somewhat flattened, c 0·6 mm wide, deeply grooved down the inner face with enlarged, shortly bifid rugulose apices. *Capsule* deeply three-lobed, 14—17·5 diam. (generally 15—16) × ± 8 mm high, truncate at both apex and base, shortly exserted from the involucre on a slightly curved, obscurely pentagonal towards the base, stout pedicel up to 7 mm long × c 3 mm diam., merging into the perianth; perianth c 6 mm diam. more or less triangular with small intermediate teeth closely adpressed to the capsule in the sinuses of the lobes. *Seed* subglobose, slightly laterally compressed, c 3·5 mm in its greatest diam., smooth

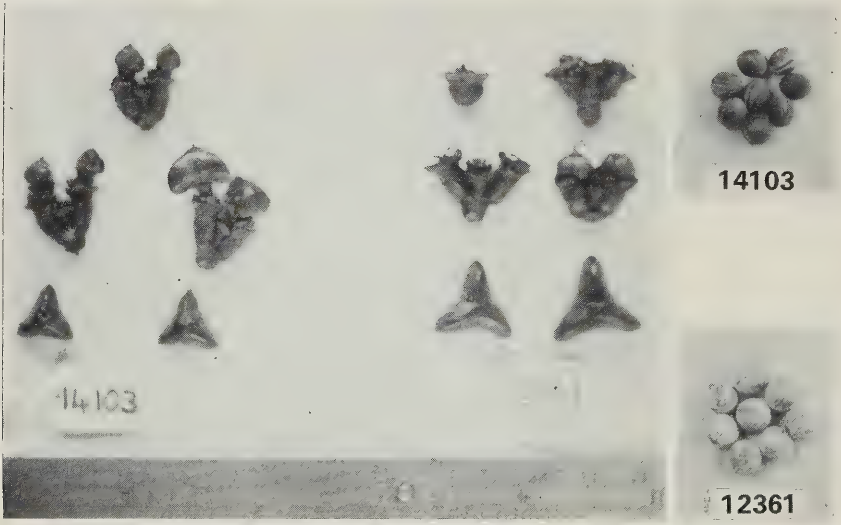


FIG. 6. A comparison: 14103 *E. cooperi* var. *calidicola*
12361 *E. angularis*
Note the more deeply-lobed, larger capsules of *E. angularis*, which are also much more subglobose at an earlier stage.

or very slightly and obscurely pusticulate, buff, pale purple clouded, minutely puncticulate with blackish purple; suture slightly raised, obtuse, brown.

From the present records it seems that *E. angularis* is restricted to Goa Island, although those authors who have considered *E. lemaireana* as being synonymous have included Zanzibar in its distribution.

Only one specimen from that island has been seen by the writer, namely, *Greenway* 1188 (EA). Although this was collected from a habitat apparently rather similar to that occupied by *E. angularis* and exhibits some of the characters of that species it is difficult to form a definite opinion without seeing material which is more complete. In some ways it is thought to be more probable that the affinities of this specimen lie with the polymorphic populations of the adjacent mainland littoral which require much more investigation before any taxonomic conclusions can be reached.

## EUPHORBIA LEMAIREANA

The identity of *E. angularis* seems to have posed a problem to taxonomists almost from its publication; one of the names most frequently tentatively placed in synonymy by various authors is that of *E. lemaireana*. It is thought to be of interest therefore to discuss this latter species in some detail.

(2) **Euphorbia lemaireana** Boiss. in DC. Prodr. **15**,2: 81 (1862).——Pax in Engl. Pflanzenw. Ost-Afr. "C": 241 (1895) et in Engl. Bot. Jahrb. **34:** 73 (1904).——Janse in Sukkulentenkunde **3:** 58 (1949).——Type: A living plant cult. Paris; ? ex Zanzibar, comm. *A. Richard* (c 1853).

*Euphorbia fimbriata* Hort. ex Lem. in Ill. Hort. Misc.: 71 (1857), non Scop. (1788).——Type as above.

*Euphorbia crispata* Lem. loc. cit. (1857) non Hornemann (1819).——Type as above.

*Euphorbia grandicornis* sensu Berger, Sukk. Euphorb.: 52 (1907) pro parte quoad syn.

*Euphorbia angularis* sensu N.E. Brown in Fl. Trop. Afr. **6**,1: 585 (1912) pro parte quoad syn.——sensu White, Dyer & Sloane, Succ. Euphorb. **2:** 881 (1941) pro parte quoad ?syn.——Jacob. Handb. Succ. Pl. **1:** 446 (1960) pro parte quoad ?syn.

Boissier's description was based on a live but sterile plant cultivated in the garden of the Paris Museum; it seems that this plant eventually died without having flowered (at least there appears to be no record of such an event). Whether the various plants in cultivation, photographs of which have been published above the name *E. lemaireana*, were actually propagated from cuttings from the Paris plant seems open to some doubt.

Boissier, who appears to have seen the live plants of both *E. angularis* and *E. lemaireana*, considered them to be distinct, and on the score of habit alone it seems scarcely possible for *E. lemaireana* (ht. 4·5 m) to have been taxonomically identical with either *E. angularis* or *E. grandicornis*, both of which are densely branched shrubs, usually less than 2 m high.

Berger, who did not mention *E. angularis* in his monograph of 1907, considered *E. lemaireana* and *E. grandicornis* possibly to be synonymous, but apart from stature the 20 cm long segments of *E. lemaireana* would appear to rule out this possibility.

The description by Boissier of a shrub with few decumbent curved branches and segments up to 20 cm long, with undulate margins and much compressed wings seems rather to point to an affinity with plants of the East African littoral and his reference to the central cylindric part of the segments would seem to be almost certain confirmation of this relationship while almost equally definitely excluding it from *E. angularis* or *E. cooperi* complex.

There are numerous populations, corresponding closely to this description, to be found along the east coast of Africa today and it seems probable that Boissier's species may be equal to one or other of these. However, in the absence of material or of any description of the inflorescence or fruits, it is felt that there is little, if any possibility of positively establishing its identity. As far as is known to the writer the name is not currently in use for any wild plants and even the Zanzibar locality seems to contain a slight element of doubt; it therefore seems pointless to speculate further on its identity, and it should in the writer's opinion, be considered as a *species non satis cognita*.

### EUPHORBIA COOPERI COMPLEX

Chronologically the next name involved is that of *E. nyikae* Pax which, considered to belong, together with other related species, to the East African grouping, is discussed in greater detail elsewhere in this paper. It suffices here to note that it is excluded from *E. cooperi* by its Phyllocacti-like, sometimes 2-winged branches and small, usually separate spine shields, as well as, it seems probable, some details of the inflorescence.

Illustrative of the uncertainties which appear to have surrounded *E. cooperi* complex since the original importation of living plants as far back as 1860, is the history of the specimen *Goetze* 1008. Identified by Pax in 1901 as *E. nyikae* it was transferred by him in 1904 to *E. angularis* and again transferred in 1912 to become the type of N.E. Brown's *E. ussanguensis* which is now reduced to varietal rank in *E. cooperi*.

(3) **Euphorbia cooperi** [N.E. Br. in Handl. Dicot. Kew: 295 (1900), nom. nud.] N.E. Br. ex Berger, Sukk. Euphorb.: 83 (1907), excl. fig. 21.——N.E. Br. in Fl. Cap. **5**,2: 386 (1915).——Pole Evans in S. Afr. Journ. Sci. **17**,1: t.7 (1920). ——Phillips in Flow. Pl. S. Afr. **4**: t.157 (1924).——Lotsy in Genetica **10**: 104 (1928).——Burtt Davy, Fl. Transv. **2**: 296 (1932).——Bremek. in Karsten & Walter, Veg.-bild. 23: tt. 15 & 16a (1932).——Oberm. Schweick. & Verdoorn in Bothalia **3**: 242 (1937).——White, Dyer & Sloane, Succ. Euphorb. **2**: 873 (1941).——Codd, Trees shrubs Kruger Nat. Park: 96 (1951).——Wild, S. Rhod. Dict. Pl. Names: 83 (1952).——Pardy in Rhod. Agr. Journ. **52**,5: 416 (1955). ——Jacob. Handb. Succ. Pl. **1**: 422 et fig. 486 (1960).——B. & M. de Winter & Killick, Sixtysix Trees Transv.: 100 (1966).——Compton, Check List Fl. Swazil.: 53, 126 (1966).

Type: Hort. La Mortola, *Cooper*, Natal, Umgeni Valley. Neotype: idem Hort Reg. Kew. (K!).

*Euphorbia angularis* sensu Engler in Engl. Pflanzenw. Afr. (Engl. & Drude, Veg. der Erde) **9**,1: 443 et fig. 376 (1910).——sensu Eyles in Trans. Roy. Soc. S. Afr. **5**: 398 (1916).——sensu White, Dyer & Sloane, tom. cit. quoad fig. 1004 (1941).

*Euphorbia grandidens* sensu Burtt Davy in Transv. Agr. Journ. **4**: t.38 (1905).——sensu Eyles, tom. cit.: 399 (1916).

Note: *E. cooperi* sensu Hutch. Botanist S. Afr.: 320/21 (1949) is, in fact, *E. confinalis* R.A. Dyer, and that of Cannon in Carnegie Inst. Wash. Publ. 354: t. 5c (1924) is *E. ingens* E. Mey. ex Boiss.

*E. cooperi sens. lat.* appears to vary more or less on the pattern of a discontinuous altitudinal cline, with a marked tendency for a reduction in altitude to be correlated with fewer thinner wings to the branches, longer spines, and more numerous male flowers. Although correlation of these variations with altitude is by no means absolute, the species does seem to fall into three, generally recognisable, altitudinally separated main groups which seem to demand some taxonomic recognition.

In choosing varietal rather than subspecific status for these the author has been influenced by the fact that despite the generally quite well defined populations there are individuals from lower hotter parts of the distributions of both var. *cooperi* and var. *ussanguensis* which can, other than on the basis of locality, and only with uncertainty, be distinguished from each other and from some examples of var. *calidicola* (such examples are, incidentally, mostly quite widely geographically separated). Furthermore, some of the distinctions appear to be largely, if not entirely, governed by climatic and/or edaphic factors, since juveniles of all three varieties, readily distinguishable when collected, have, after some 8—9 years in cultivation, come more closely to resemble each other in one or two of their vegetative characters, particularly in shape of segments.

Individual variability is such that it may often be virtually impossible to identify some herbarium specimens at varietal level except from their locality, especially as some characters inevitably become lost or obscured in the preparation of this most difficult to handle material.

Common to all three taxa is the exceptional acridity of the latex; one's lips and nostrils are almost always affected after gathering or preparing material.

Populations in which all or almost all the individuals adopt a shrub-like habit as opposed to the more usual tree-like habit, so typical of most plants of var. *cooperi*, are occasionally encountered in all three varieties. The overall appearance of these colonies is sometimes so distinctive that one is liable to gain the impression that distinct taxa may be involved, but on investigation there seems to be no doubt that these are but localised forms of one variable species.

### (3a) Var. **cooperi**

The typical variety is characterised by its generally 4—6-angled branches with more or less conic-ovate segments and relatively stout wings with continuous, more or less even or slightly sinuate-toothed, horny margins which are generally about 5—6 mm wide and armed with relatively short, stout, widely diverging paired spines, usually less than 10 mm long; the capsule is shortly exserted from the involucre on a stout, more or less truncate obconic, slightly curved pedicel. Seedlings of this variety are relatively stout, usually soon developing 4—6 angles, generally scarcely winged, green or dark green, often marbled.

Its distribution extends from Natal, more or less throughout Swaziland, the Transvaal and Rhodesia with some slight extensions into the western regions of southern Moçambique, generally at altitudes of ± 1000 ft.—4500 ft. (rather rarely below ± 1500 ft.).

Judging by N.E. Brown's notes on the type sheet of *E. cooperi* there seems to be no doubt that Cooper's plant was discovered in the Umgeni Valley, where he is stated to have seen "only a few plants". Unfortunately however, Cooper's locality has not been rediscovered, the most southerly subsequent record being from the Umhlatusi Valley (c 28° 45′ S), *J.S. Lawn* 527 (NH), (personal comm. Mr. C. J. Ward, University College, Durban).

The history of this variety, at least as applicable to the S. African portion of its distribution, has been dealt with in detail by White, Dyer & Sloane in their monograph of 1941 and will not, therefore, again be discussed here.

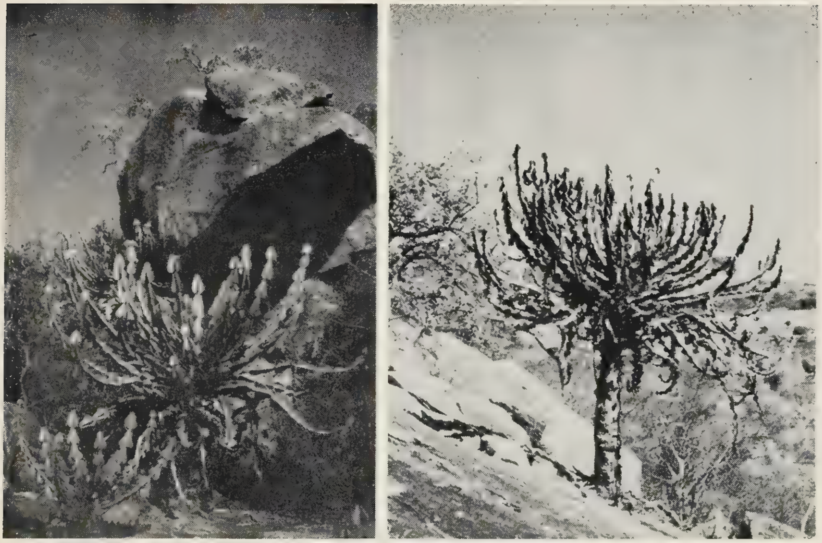


FIG. 7. *Euphorbia cooperi* var. *cooperi*.
*Leach* 11635, Nelspruit. *Leach* 9244, Mtoko.

Plants, mostly less than 20 ft. high, generally form discrete, usually densely populated colonies, often on hillsides, where they then become a conspicuous component of the vegetation.

The flowering period appears to be exceptionally long, as may be judged from the records, e.g. complete flowering material was collected from a plant growing near Moodie's Pass in the Bikita District of Rhodesia on 22.v.1959 and the same individual was still bearing unripe capsules and some less developed cyathia on the 27th of August in the same year.

Individuals at some of the Rhodesian and Moçambique low altitude localities, conforming to the overall variation trend of the altitudinal cline, often display a proportion of 3-winged branches, but it is rarely that such branches predominate.

The styles may vary in length from ± 2 mm, free almost to the base, to ± 5·5 mm, united for two-thirds their length; variations encompassing almost the whole of this range sometimes occurring in a single individual.

Capsules are normally more or less triangular or only slightly lobed when seen from above, and are generally ± 10 mm broad × 6 mm high, but individuals occur in which fruits may be up to 13·5 × 7·5 mm while more rarely, plants bearing relatively deeply lobed capsules may be found.

Although these variations appear to be identified with individuals there does not seem to be any other correlated factor or character variation.

Rhodesia. N. Mrewa Distr.: Mazoe Riv., Maramba Res., 2700 ft., fl. 7.viii. 1959, *Leach* 9264 (EA; K; PRE; SRGH); Maramba Miss., fr. 7.viii.1959, *Leach* 9270 (K; PRE; SRGH; ZSS). Mtoko Distr.: *Christian* 377 (PRE); 2 mls N of Mtoko, 3700 ft., fl. 24.vii.1959, *Leach* 9244 (BR; K; PRE; SRGH); ± 20 mls. SW of Mtoko, fl. 23.vii.1959, *Leach* 9238 (K; PRE; SRGH; ZSS).

W. Matobo Distr.: S. Matopos, fl. & fr. Oct. 1963, *Bullock* in *Leach* 11706 (EA; K; SRGH); Diana's Pool, fr. 12.ix.1955, *Plowes* 1875 (SRGH); Matopos, fl. 19.vi.1955, *Plowes* 1860 (PRE; SRGH); Matopos, fr. Aug. 1955, *Miller* 2957 (BUL).

C. Hartley Distr.: Battlefields, 3600 ft., fl. 31.viii.1956, *Whellan* 1121 (SRGH). E. Chipinga Distr.: ± 12 mls. N of Rupisi Hot Springs, fl. & fr. 11.x.1959, *Leach* 9458 (PRE; SRGH); ibid. fl. & fr. 25.ix.1965, *Leach & Müller* 13137. (K; LISC; PRE; SRGH; ZSS); Umtali Distr.: ± 21 mls. N of Umtali, fl. & fr. 19.vii.1964, *Leach & Chase* 12308 (K; LISC; PRE).

S. Gwanda Distr.: Marangudzi, 2300 ft., fl. 10.v.1958, *Drummond* 5756 (LISC; PRE; SRGH); Shashi/Simlala Riv. Junct., fl. 8.v.1959, *Drummond* 6113 (PRE; SRGH); Sentinel Ranch, st. 24.iii.1959, *Drummond* 5981 (SRGH); ± 12 mls. N of West Nicholson, fl. 2.viii.1930, *Gillett* 3857 (BOL; PRE). Chibi Distr.: Lundi Riv. Br., fl. 6.v.1963; idem, fr. 11.viii.1963, *Leach* 11647 (K. LISC; M; MO; PRE; SRGH; ZSS). Victoria Distr.: Zimbabwe, fl. 14.viii.1937, *Mogg* s.n. (PRE). Bikita Distr.: ± 10 mls. W of Moodies Pass, 3500 ft., fl. 24.v.1959, *Leach* 9017 (PRE; SRGH); idem, fr. 27.viii.1959, *Leach* 9321 (K; PRE; SRGH); Devuli Riv., *Noel* s.n. (SRGH); near Birchenough Br., *Stock* s.n. (PRE; SRGH), Ndanga Distr.: Sabi/Lundi Riv. Junct., 800 ft., fl. 5.vi.1950, *Wild* 3398 (PRE; SRGH), *Hall* 100, 11.vi.1950 (NBG). Nuanetsi Distr.: NW Mateke Hills, 2400 ft., 4.v.1958, *Drummond* 5554 (PRE; SRGH).

Transvaal: 2229 (Waterpoort): near Ingwe Motel, Zoutpansberg (-DD), fl. 29.v.1963, *Leach 11680* (FHO; M; MO; PRE; SRGH); Zoutpan (-D), fl. 15.iv.1934, *Schweickerdt & Verdoorn 649* (PRE); Waterpoort (-D), st. 23.i.1959, *Werdermann & Oberdieck 1996* (PRE).

2230 (Messina): 6 mls. NW of Punda Maria (-D), 18.v.1949, *Codd & De Winter 5563* (PRE).

2231 (Pafuri): near Makulek, S of Levubu Riv., fr. Aug. 1937, *Van der Merwe 1451* (PRE).

2329 (Pietersburg): ± 30 mls. N of Pietersburg (-BC), fr. 6.ix.1963, *Leach 11714* (PRE); ± 18 mls. E of Pietersburg (-DD), fl. 3.viii.1961, *Van Vuuren 1216* (PRE).

2429 (Zebediela): "near a kaffir village, Potgietersrust Distr." *Marloth 5143* (K; PRE); "Zebedela's location", hort. *Marloth 7996* (PRE); Botsebelo Mission, Little Oliphants Riv., fl. & fr. July 1923, *Anon* in *Marloth 11759* (PRE).

2430 (Pilgrims Rest): Penge Mine, Lydenburg Distr., (-AD), fl. 12.vii.1936, *Van der Merwe 1004* (PRE); Haakdoorndraai (-BD), fr. 15.v.1965, *Leach & Jones 12822* (PRE); Driekop, Sekukuniland (-CA), fl. & fr. 21.iv.1935, *Barnard 25* (PRE); Sekukuniland, fr. 3.xi.1935, *Barnard 433* (PRE):

2527 (Rustenburg): 3 mls. W of Rustenburg (-CA), *Phillips & Schweickerdt* (PRE); Buffelspoort Farm, near Sterkstroom (-DA), *Burtt Davy 5993* (PRE); Brits (-D), fl. 31.v.1935, *Dyer 3183* (PRE); fl. ♂, 22.iii.1935, *Mogg s.n.* (PRE); fl. 2.v.1958, *Van Vuuren 536* (PRE). 2529 (Witbank), Trichardt's Poort, ± 55 mls. from Pretoria, fl. 27.vi.1935, *Dyer 3189* (PRE). 2530 (Lydenburg), 3 mls. S of Nelspruit (-DB), fl. 28.iv.1963, *Leach 11635* (K; PRE; SRGH).

2531 (Komatipoort): Komatipoort (-BD), *Rogers s.n. 2504* in Herb. Transv. Mus. (K; PRE); Kaapmuiden (-B), fl. July 1936, *Van der Merwe E16* (PRE).

SWAZILAND. 2631 (Mbabane): Forbes Drift, Komati Riv. (-AA), cult. Manzini, fr. 20.viii.1963, *Stark in Leach 11715* (PRE; SRGH).

NATAL. 2731 (Louwsburg): 7 mls. S of Mkusi on Nongoma Rd. (-DB), fl. 11.iii.1964, *Edwards 3289* (PRE); 4—5 mls. N of Magut (-B), *Dyer 3476* (PRE).

MOÇAMBIQUE. **LM.** Namaacha, fl. 2.v.1964, *Balsinhas* 717 (LISC); ibid. fr. 25.viii.1967, *Gomes e Sousa* & *Balsinhas* 4952 (LMA; PRE).

**T.** Tete Distr., Mazoe Riv. 6 mls. from Rhodesian border, *Wild* 2603 (SRGH).

**SS.** Sul do Save Distr., Dumela, fl. 11.vii.1964, *Leach H.H. & D.C. Mockford* 12300 (BM; BR; EA; G; K; LISC; MO; PRE; SRGH).

(3b) Var. **ussanguensis** (N.E. Br.) Leach, stat. nov.

*Euphorbia ussanguensis* N.E. Br. in Fl. Trop. Afr. **6**,1: 587 (1912).—— Brenan & Greenway, T.T. Check List **2:** 214 (1949).——Type: Tanzania, Ussangu, *Goetze* 1008 (B† K!).

*Euphorbia nyikae* sensu Pax in Engl. Bot. Jahrb. **30:** 342 (1901).——sensu Goetze & Engl., Veget. Deutsch Ost-Afr.: t.58 (1902).

*Euphorbia angularis* sensu Pax in Engl. Bot. Jahrb. **34:** 76 (1904) pro parte quoad syn. *E. nyikae* et specim. *Goetze* 1008.

*Euphorbia strangulata* sensu Hutch. Botanist S. Afr.: 532 (1949).

Basionym: *Euphorbia ussanguensis* N.E. Br.

TANZANIA. ± 5 mls. N of Zambian border on Sumbawanga road, c 5700 ft. alt., fl. 16.vi.1960, *Leach & Brunton* 10053 (PRE; SRGH); near Sopa Barrier, fl. 16.vi.1960, *Leach & Brunton* 10054 (K; LISC; SRGH); ± 26 mls. E of

Mbeya, 4100 ft. alt., fl. 25.vi.1960, *Leach & Brunton* 10105 (SRGH); Kalenga, ± 20 mls. WNW of Iringa, fl. 25.vi.1960, *Leach & Brunton* 10124 (B; SRGH); Kitonga Escarp. E of Iringa, 4300 ft. alt., fl. 26.vi.1960, *Leach & Brunton* 10125 (BR; EA; K; PRE; SRGH); "20 mls. N of Toroto Range", *Pole Evans & Erens* 766 (PRE).

Note: *Greenway & Kanuri* 13532, from SW side of Ngorongoro Crater appears to belong here, but identification is not certain as it is difficult to be sure of the arrangement of the inflorescence and the capsule is somewhat larger than usual for this taxon. (I have, unfortunately, not seen the spirit material).

There are other specimens which are either sterile or for some other reason not certainly identifiable which also probably belong here, e.g. *Verdcourt* 2885 (PRE), from Mwanza at the southern end of Lake Victoria; however, the long, narrow tapering segments and 4-angled section of this specimen, considered in conjunction with the locality, seem to indicate *E. hubertii* Pax as being likely to be its correct identification, as it possibly is also for *Verdcourt* 3434 (PRE), from a rock outcrop near Kigoma and *Greenway* 10741 (PRE) from Campi ya Mawi.

*E. hubertii* is, however, an imperfectly known species and further investigation is required before any decision can be reached regarding its status. Superficially there certainly seems no reason why these specimens as well as the photograph of plants on an island in Lake Victoria (?Winkler 4114a) in Winkler, Das Leben der Pflanze, **3:** 484 (1913), should not belong in *E. cooperi* complex.

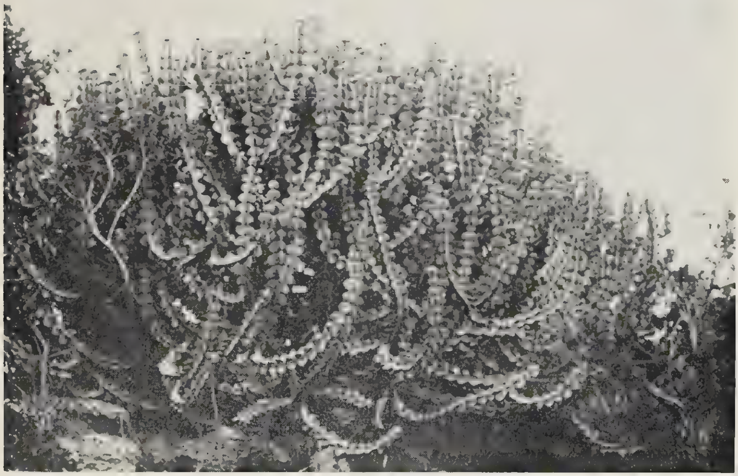
Zambia. **N.** Mansa (Fort Rosebery): bud, 11.v.1964, *Fanshawe* 8621 (NDO; SRGH); Mpika, fl. 13.viii.1965, *Fanshawe* 9281 (SRGH); Kawambwa, young fr. *Fanshawe* 3870 (NDO), Ntumbachushi Falls, st. *Williamson* 1351 (SRGH); ?Sunzu "Sungu", fl. 25.vi.1955, *Lawton* 212 (NDO); ± 15 mls. SE of Mbala (Abercorn), fr. *Whellan* 2123 (PRE; SRGH).

**C.** 32 mls. NE of "Serenje Corner", 5200 ft. alt., fl. ♂, 25.vii.1930, *Hutchinson & Gillett* 4083 (BM); 31 mls. N of Kanona, bud, 14.vi.1960, *Leach & Brunton* 10043 (K; LISC; NDO; PRE; SRGH); between Serenje and Mpika, fl. 16.vii.1930, *Pole Evans* 2897 (PRE; SRGH); Shiwa Ngandu, 5400 ft. alt., st. 22.vii.1938, *Greenway* 5472 (NDO); Kundilila Falls, E of Kanona, ± 5000 ft. alt., *Williamson & Simon* 546 (SRGH).

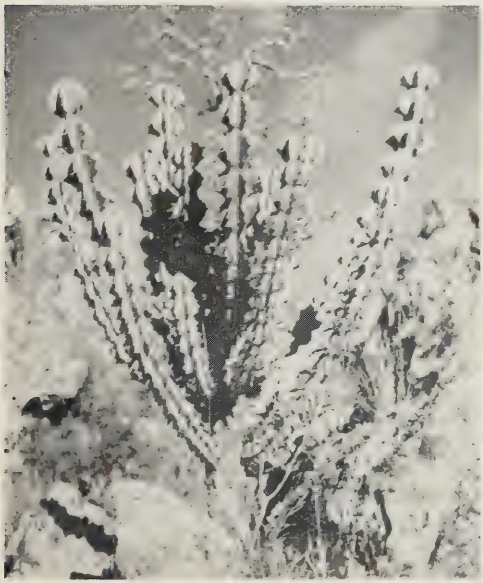
**E.** Lundazi, fl. 16.viii.1965, *Fanshawe* 9275 (SRGH).

Note: *Fanshawe* 3870, Kawambwa is included here mainly on the basis of its locality, and that *Williamson* 1351, also from Kawambwa, appears to be a good match for the variety. However its thinly 3-winged branches and ± obsolete spinescence may indicate the desirability of further investigation of the populations in this area.

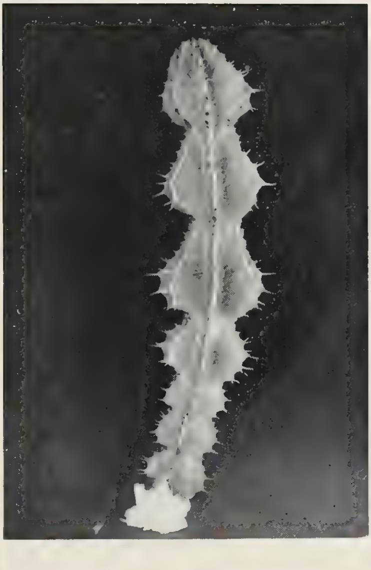
Malawi. **N.** Rukuru Riv., ± 2 mls. S of Rumpi, plants plentiful in wooded gorge, juvenile Hort. Leach., *Leach & Brunton* 10355.



Plant ± 3·5 m high, with remarkably regularly shaped segments and elongated persistent branches, SW of Lake Rukwa, Tanzania.



Small plant ± 2 m high, ± 30 mls. N of Kanona, Zambia.



Branch shewing gradual development of segments from small subcircular to conic-ovate. Cultivated Nelspruit.

FIG. 8. *Euphorbia cooperi* var. *ussanguensis Leach & Brunton* 10043.

Var. *ussanguensis* differs from both the typical variety and var. *calidicola* in the character of its branches, the segments of which are usually quite characteristically regularly shaped, being most frequently circular or subcircular in outline. The winged angles are generally more stout and the usually crenate horny margins correspondingly wider (sometimes up to 10 mm). There is also a tendency for the wings to be more numerous than in either of its relatives (the count sometimes rising to nine). The "peculiar fold-like sinuations" of the margins, mentioned by N.E. Brown are, it appears, not constant in the variety, neither is this peculiarity, although certainly more prevalent in var. *ussanguensis*, restricted thereto, similar crenate margins sometimes occurring in var. *calidicola*.

The inflorescence of this variety is generally somewhat shorter than those of its two closest relatives, due mainly to the shorter, more or less straight pedicel on which the sometimes slightly smaller capsule is borne.

Var. *ussanguensis* is possibly the most clearly differentiated of the three taxa, and considered in relation to typical plants of var. *calidicola* would probably be separated at specific level; however, the overall similarity and the extent to which they approach each other at the lower and upper extremes of their respective altitudinal ranges seems to leave little doubt regarding their conspecific identity.

The straight stout pedicel probably constitutes the most distinctive character of this taxon, and the author several times debated whether or not separation should be at subspecific level. However, the length of this organ is quite variable in the other two taxa involved; it seemed therefore, to be merely part of the general pattern of variation. In these circumstances it was finally decided that varietal rank was most appropriate.

Seedlings of var. *ussanguensis* are nearest in appearance to those of var. *cooperi* but are of generally stouter habit, usually with more, more deeply winged angles, and have a tendency to branch more freely and at an earlier stage.

This variety occurs generally at altitudes of 4000—6000 ft.; its known distribution extends northward from near Serenje in the Central Province of Zambia, possibly to beyond Ngorongoro Crater and Mwanza at the southern end of Lake Victoria, and eastward to the escarpment beyond Iringa. Its occurrence in the neighbouring Congo Republic is also thought to be most probable.

(3c) Var. **calidicola** Leach, var. nov.
*Euphorbia* sp. 1, White, For. Fl. N. Rhod.: 199 (1962).
*Euphorbia angularis* sensu Boughey in Jl S. Af. Bot. **30:** 162 (1964).

A varietatibus affinibus ramorum segmentis formis et magnitudinibus variantissimis, alis tenuioribus paucioribus, marginibus corneis tantum c 3 mm latis, valde vel leviter sinuato-dentatis vel interdum crenatis; inflorescentia plerumque longiore, capsula longiore exserta pedicello longiore differt.

Type: Rhodesia, Wankie Distr.: *Leach & Cannell* 14103 (K; LISC; SRGH, Holo.).

ZAMBIA. **E.** Petauke, E. bank of Luangwa Riv., near bridge, 5.ix.1947, *Greenway & Brenan* 8057 (PRE). **S.** Lusitu, hillsides N of Kariba, fl. 22.v.1961, *Fanshawe* 6605 (NDO); ibid. *Williamson* in *Leach* 13538 (FHO; NDO; PRE; SRGH).

RHODESIA. **N.** Between Sebungwe Drift and Binga, fl. 14.v.1955, *Plowes* 1849 (PRE; SRGH).

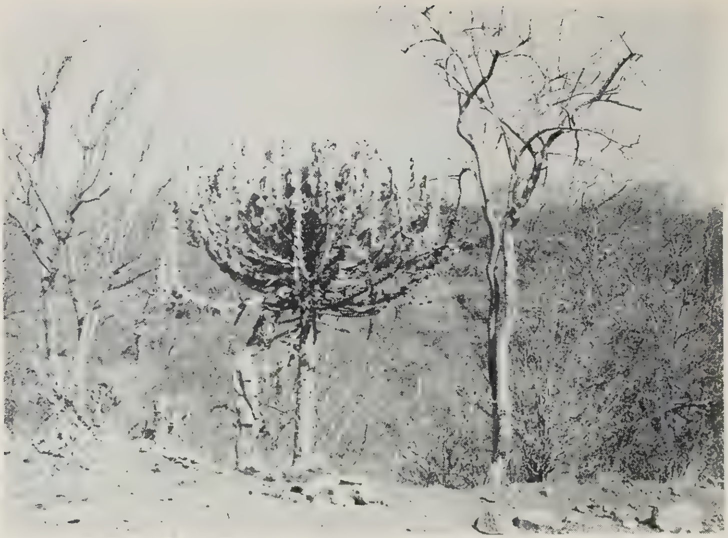
**W.** Wankie Distr.: Deka/Shashachunda Riv. junct. fl. 16.vii.1968, *Cannell* 52 (K; LISC; SRGH), ibid, fr. 24.viii.1968, *Leach & Cannell* 14103 (K; LISC; SRGH), 14103A (K; PRE), 14103Aa (K; MO; PRE; ZSS); Deka Riv. 26.iv.1959, *Leach* 8964 (PRE; SRGH); Lukosi Riv., 28.iv.1959, *Leach* 8972 (PRE; SRGH); near Inyantue Riv. 29.iii.1963, *Leach* 11611 (BR; EA; K; LISC; PRE; SRGH); Deka Riv., 31.iii.1963, *Leach* 11620 (K; FHO; PRE; SRGH); ± 10 mls. S of Wankie, fr. 24.viii.1968, *Leach & Cannell* 14104 (LISC; SRGH).

MALAWI. **S.** Monkey Bay, Lake Malawi, *Eccles* s.n. (SRGH); Mpatamanga Gorge, Shire Riv. ± 1100 ft. alt., fl. 16.viii.1960, *Leach* 10458 (B; BR; K; PRE; SRGH).

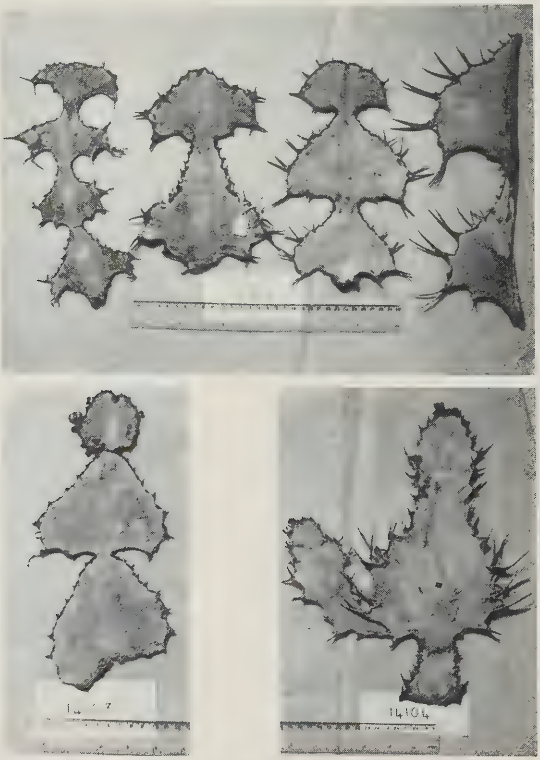
MOÇAMBIQUE. **T.** Tete Distr.: Mazoe/Luenha Riv. junct., fl. 6.v.1960, *Leach* 9935 (BR; K; LISC; MO; PRE; SRGH; ZSS); near Mazoe Riv. Br., fl. 6.v.1960, *Leach* 9938 (G; K; LISC; SRGH); ± 1 mile NE of Tete, fl. 17.viii.1960, *Leach* 10459 (K; PRE; SRGH).

**MS.** Manica e Sofala Distr.: between Tambara and Belo, broken basalt ridges below Lupata Gorge, fl. 14.vii.1969, *Leach & Cannell* 14330 (BM; K; LISC; LMA; SRGH).

Var. *calidicola* differs from the typical variety in having branches which are constricted into segments of extremely variable shape and size, with fewer broader wings only about 3 mm thick at the margins, which may be strongly or weakly sinuate-toothed or sometimes crenate and are often flexuosely undulate. Spinescence is also very variable, sometimes, although rarely, on very robust specimens almost rivalling that of *E. grandicornis*, but more usually



Mr. I. C. Cannell examining plant at Deka Valley, Wankie Distr., Rhodesia. *Leach & Cannell* 14103.



Variation in spinescence and segment shape of specimens from Wankie District, Rhodesia.
FIG. 9. *E. cooperi* var. *calidicola* Leach.

it is weak and often almost obsolescent. The inflorescence is usually longer than that of var. *cooperi*, with the capsule usually relatively far exserted on a pedicel up to 10 mm long; this however, appears to be a variable character, as it is also in the typical variety, in which equally long pedicels may occasionally be found.

A tendency to develop secondary and tertiary cymes, previously noted in respect of *E. angularis* is also to be observed in this taxon. Since, however, this tendency appears to develop only at some localities it is thought that it may be due to ecological conditions rather than to any inherent genetic influence.

The distribution of this variety appears to be restricted to the lower altitudes in the hot dry valleys of the Zambesi and some of its tributaries, from Wankie to its confluence with the Shire River, where its occurrence overlaps territorially with that of *E. halipedicola;* upstream along the Shire River plants are to be found near Port Herald, and, in dense woodland, at Mpatamanga Gorge, and again on the western shores of Lake Malawi (Nyasa) in the vicinity of Monkey Bay.

Oddly enough it does not appear to occur to the east of the Shire Riv. or the Lake; the writer has certainly not seen it, nor does it appear to be otherwise recorded.

Seemingly it is a strictly riverine variety which, like the typical, tends to form relatively densely populated colonies, although usually in more open situations; smaller and more scattered groups occurring in thickets or woodland.

It is perhaps of interest to note that the distribution of this taxon (that portion from Wankie to the Kafue Riv. confluence) coincides almost exactly with that of the equally variable and polymorphic *E. persistentifolia* Leach; the two, frequently growing socially, are often associated, although usually less closely, with a third rather variable species: *E. malevola* Leach.

The occurrence of these three variable representatives of three distinct groups in the same area (a fourth: *E. fortissima* Leach is scarcely to be described as very variable) leads one to speculate on the possible evolutionary implications, particularly in relation to some less variable but closely related species from contiguous or connected areas.

## EUPHORBIA GRANDICORNIS

Although the exact type locality of *E. grandicornis* is not known there appears to be no doubt regarding the identity of this distinctive species which is still plentiful in Zululand today.

The first valid description, published by N.E. Brown in 1897 was, according to Carter in Flow. Pl. Afr. **36:** t.1408 (1963), based on a plant cultivated at Kew, which was collected by Stone in Zululand, near the Umfolozi River.

The epithet "grandicornis" had, it seems, been in use for some while prior to 1889 and has, since that date, generally been attributed to Goebel; however, his publication was unaccompanied by an adequate description and must, therefore, be considered to be a *nomen nudum.*

(4) **Euphorbia grandicornis** [Goebel in Pflanzenbiol. Schild. **1:** 42 (1889) nom. nud.]; Goeb. ex N.E. Br. in Hook. Ic. Pl. **26:** t.2531, 2532 (1897).——Berger, Sukk. Euphorb.: 52 (1907).——N.E. Br. in Fl. Cap. **5,2**: 367 (1915) pro parte excl. syn. *E. breviarticulata.*——R.A. Dyer in Flow. Pl. S. Afr. **17:** t.642 (1937) p.p. et in Cact. Succ. Journ. Americ. **9:** 83 (1938), p.p.——White, Dyer & Sloane, Succ. Euphorb. **2:** 861 (1941) p.p. excl. syn. *E. breviarticulata.*——Jacob. Handb. Succ. Pl. **1:** 435 (1960) p.p. excl. distrib. Tanzania and Kenya.——Carter in Flow. Pl. Afr. **36:** t.1408 (1963).——Compton, Swazil. Check List: 53 (1966).——Type: cult. Kew, "Zululand" *Stone* s.n. (K!).

*Euphorbia grandidens* sensu Goeb., loc. cit.: t.15, non Haw.

The distribution of this species appears to be restricted to lowveld areas (generally below 1500 ft. altitude) of Zululand, Swaziland, and the Lourenço Marques and Sul do Save Districts of Moçambique, to as far north as Chibuto, not far from Vila de João Belo. There is also a strangely disjunct population, now considered to be distinct at subspecific level, to be found on granite slopes in the vicinity of Nampula in northern Moçambique.

*E. breviarticulata* Pax, until now generally accepted as being conspecific with *E. grandicornis* is recognised by the writer as being distinct. The reasons for this decision and the differences between the two species are discussed in the following pages.

The spines of these three taxa are usually remarkably terete, whereas those of related species, such as *E. halipedicola*. tend almost always to be flattened or oval in cross-section towards the base.

(4a) Subsp. **grandicornis**

Plants generally form close colonies on flats, in more or less open country, on the deep soils of the coastal plain. Branches are usually described as 3-angled but 4-winged specimens occur and may even predominate in some areas of Maputoland where the species is often found in thick bush, often associated with *E. confinalis* R. A. Dyer, *E. knuthii* Pax, *Aloe bainesii* Th. Dyer, *A. suffulta* Reyn. and numerous other succulent species.

MOÇAMBIQUE. **SS.** Sul do Save Distr.: Chibuto, N of Vila de João Belo, fl. 29.ix.1959, *Mogg* 29718 (SRGH).

**LM.** Lourenço Marques Distr.: ± 10 mls. S of Boane, fr. 22.vii.1961, *Leach*

11207 (EA; K; PRE; SRGH); Bela Vista road SW of Lourenço Marques, cult. Greendale, fl. 18.ix.1958, *Leach* 5063 (K; SRGH); ± 17 mls. N of Moamba, c 200 ft. alt., fl. 29.ix.1963, *Leach & Bayliss* 11752 (EA; SRGH); near Catuane, fl. 19.iv.1944, *Torre* 6481A (LISC); ± 10 mls. W of Lourenço Marques, st. *Van der Merwe* E15, (PRE); near Umbeluzi, fl. & fr. 20.vi.1969, *Leach* 14247 (LISC; LMA; PRE; SRGH).

SWAZILAND. 2631 (Mbabane): Stegi Distr., near Komati Canal (-B), fr. 4.ix.1959, *Compton 29044* (PRE).

NATAL: 2731 (Louwsburg): flats between Lebombo and Magut, fr. 19.vii.1936, *Dyer 3471* (PRE); ± 11 mls. N of Magut, *Dyer 3474* (PRE); Magut, *Irons* s.n. (PRE); Magut bush, *Pole Evans 2658* (PRE).

2732 (Ubombo): Mkusi Flats, Ingwavuma Distr., *Wells 2184* (PRE).

2831 (Nkandla): Hlabisa (-BB), fl. 28.vi.1955, *Ward 2644* (LMA; PRE); Middledrift, Tugela Valley, (-CC), *Edwards 1430* (PRE); Mambula area, overlooking Tugela Valley, *Dyer 4349a* (PRE); near confluence of Begamusi and Black Umfolozi Riv., *Gerstner* in *Marloth 13543* (PRE); Middledrift road. Tugela Valley, *West* s.n. (PRE). Zululand, Umfolozi Riv., hort. Kew, ♂ fl., *Stone* s.n. (K).

Subsp. **sejuncta** Leach, subsp. nov.

A subspecie typica affinis sed planta parvissima interdum procumbenti (altitudine minor quam 1 m); ramis plerumque 2—3-alatis; spinis longitudine variabilissima differt.

Type: Moçambique, *Leach & Schelpe* 11437 (K; LISC; MO; PRE; SRGH, holo.).

MOÇAMBIQUE. N. Moçambique Distr.: granite slopes ± 6 mls. E of Nampula, alt. c 1250 ft., fl. 23.vii.1962, *Leach & Schelpe* 11437 (K; LISC; MO; PRE; SRGH); ibid., cult. Greendale, fl. 9.xi.1961, *Leach & Rutherford-Smith* 10967 (EA; SRGH); Serra Chinga, ± 30 km. E of Ribaué, prostrate on rocks, fr. 10.x.1968, *Macedo* 3704 (LMA).

Subsp. *sejuncta* differs from the typical subsp. in being a much smaller plant, usually attaining only ± 0·6 m in height (not exceeding 1 m) and sometimes procumbent, with 2—3-winged branches (very rarely 4-winged), 2-winged sometimes predominating: the spines, although similar in all other respects, are much more variable in length than those of either subsp. *grandicornis* or *E. breviarticulata*, although when long equalling the longest of these. In the specimens examined the male flowers were more numerous (± 50 : 25); however, as only a limited quantity of material was available it is not known to what extent this character may vary.

In 2-winged branches and sometimes oblong segments there is a link with *E. halipedicola*, although in most other respects the taxa are quite different. Possibly of importance in this relationship is the origin and development of the prickles associated with the leaf. In the new subsp. these appear to originate in the same manner of those of *E. halipedicola*, in which the lower portions of the leaf margins persist when the remainder of the leaf falls. Subsequent development of the horny margin causes these remnants to become separated from the inconspicuous leaf scar. In subsp. *grandicornis* and *E. breviarticulata* however, the prickles appear to be distinct from the leaf at all stages of development.

Distribution appears to be restricted to granite slopes in the Nampula region, a habitat in all respects different from the coastal plains and equally distinct from the desert and semi-desert conditions under which its more northerly relative thrives.

It is because of its spatial and ecological isolation combined with its apparent links with other taxa that subspecific rank is considered to be most indicative of the possible evolutionary position of this disjunct population.

It is interesting to note that another relative, namely, *E. grandialata*, R. A. Dyer (which is closely related also to *E. cooperi*), occurs in an equally isolated habitat on dolomite hillsides in the Lydenburg Distr. of the Eastern Transvaal.

### EUPHORBIA BREVIARTICULATA

*E. breviarticulata* was described by Pax in 1904, based on an *Engler* gathering from the West Usambaras; that this might be conspecific with *E. grandicornis* was first suggested by N. E. Brown in Flora Capensis (1915). This suggested synonymy appears to have been generally accepted by the majority of authors for some time past, but various differences noted during an investigation into the relationship of *E. angularis* and *E. grandicornis* caused the writer to doubt the correctness of this synonymy and it is now considered that *E. breviarticulata* should be reinstated as a species distinct from the latter.

(5) **Euphorbia breviarticulata** Pax in Engl. Bot. Jahrb. **34:** 84 (1904).——N.E. Br. in Fl. Trop. Afr. **6,**1: 582 (1912).——Eggeling & Dale, Indig. Trees Uganda Prot. Ed. 2: 126 (1951).

Type: Tanzania, W. Usambaras, *Engler* 1184.

*Euphorbia grandicornis* sensu N.E. Br. in Fl. Cap. **5,**2: 367 (1915) pro parte quoad syn. *E. breviarticulata.*——R. A. Dyer in Fl. Pl. S. Afr. **17:** t.642 (1937) pro parte, et in Cact. Succ. Journ. Americ. **9:** 83 (1938) pro parte.——White, Dyer & Sloane, Succ. Euphorb. **2:** 861 (1941) pro parte.——Brenan & Greenway, T.T. Check List **2:** 213 (1949).——Jacob. Handb. Succ. Pl. **1:** 435 (1960) pro parte quoad syn. et distrib. E. Africa.——Dale & Greenway, Kenya Trees, Shrubs: 198 et fig. 37 (1961).——Carter in Fl. Pl. Afr. **36:** t.1408 (1963) pro parte quoad distrib. E. Africa.

ETHIOPIA. W of Yavello, towards Sagan Riv., 4200 ft. alt., *Bally* B9258 (EA).

SOMALI REPUBLIC. Hawina, "common along road to Afmadu", c 400 ft. alt., fl. 14.ii.1941, *West* 5330 (PRE).

KENYA. Northern Prov.: Lodwar Flats, st.iii.1940, *Leakey* s.n. (EA; PRE); Lorengipe, 64 mls. S of Lodwar, 2500 ft. alt., st. 11.iv.1954 (EA); SW of Lodwar, foot of escarp., Moroto road, fl. 9.x.1952, *Verdcourt* 806(EA); Moyale, 15 km towards Wajir, 2600 ft. alt., st. 20.viii.1952, *Gillett* 13734 (EA); Turkana Desert, st. *Pole Evans & Erens* 1566 (PRE). Coast Province, near Voi, fr. 14.vii. 1960, *Leach & Bayliss* 10241 (EA; K; PRE; SRGH).

TANZANIA. Northern Prov.: S. Pare Mtns. between Makanya and Hedaru, ± 2000 ft. alt., fr. 8.vii.1942, *Greenway* 6576 (EA; PRE); Steppe E of Pare Mtns., near Kihurio, 17.xii.1901, *Uhlig* s.n. (EA).

Note: Some specimens from the southern Somali and Kenya coast as well as the W. Usambaras appear to be somewhat intermediate between plants of the Tanzanian coastal populations and the inland *E. breviarticulata;* these, as well as those from the Tanzanian coast require further investigation.

The most important difference, in the writer's opinion, between *E. grandicornis* and *E. breviarticulata* lies in the entirely different arrangement of the inflorescence. That of *E. grandicornis* is of the more conventional pattern, in which 1—3 cymes are produced from each flowering eye, these being arranged horizontally, i.e. at right-angles to the margin, each bearing 3 cyathia vertically arranged; whereas that of *E. breviarticulata* comprises a number of cymes (up to 6 seen) haphazardly arranged. This arrangement seems, perhaps, to be implicit in Pax's original description, which includes "inflorescentiae umbelliformis ramis 3—4 crassiusculis 4 mm crassis semel dichotomis"; "umbelliformis ramis 3—4" seeming to indicate some arrangement differing from that usually found in the spine-paired species. A further distinguishing character is the nature of the initial central cyathium which, in Pax's species appears always to be male deciduous (? "semel dichotomis") but in *E. grandicornis* seems usually, if not always, to be persistent (as in the associated *E. cooperi*).

The cymes of *E. breviarticulata* are usually considerably longer than those of its relative, particularly in fruit, when the larger (14·5—15·5 mm diam.: 10—12 mm), more deeply lobed, apically truncate (somewhat pyramidal in *E. grandicornis*) capsule is exserted, usually well clear of the involucre on a stout pedicel about 5 mm long (± 2—2·5 mm in *E. grandicornis*); the styles of Pax's species are free almost to the base, those of the S. African plants being united for about half their length. In the material dissected the male flowers have been found to be more numerous in *E. breviarticulata* (38 : 22) but it is not possible to judge the extent to which this may be constant as only a few specimens have been examined for this character.

Finally the segments of the East African plants appear to be more or less uniformly twice as broad as long, whereas in *E. grandicornis* these dimensions are generally more or less equal.

Pax's description appears to be drawn up from a very small specimen with segments only 6 cm broad × 3 cm long, with correspondingly shorter spines only 2·5 cm long as compared with the more normal 4·5—5 (6) cm of the material examined.

The reported difference in gland surface is thought to be unimportant, since this appears, at least to some extent, to be dependent on the age of the glands.

*E. breviarticulata* inhabits the desert and semi-desert areas of East Africa, its known distribution extending from the Usambaras in Tanzania to southern Somalia and Ethiopia. Its occurrence appears, from the records, to be of a somewhat sporadic and intermittent nature, but this may be due, in part to the understandable unpopularity with collectors, of the more spiny members of the genus.

## EUPHORBIA HALIPEDICOLA

(6) **Euphorbia halipedicola** Leach, sp. nov.

*Euphorbia angularis* N.E. Br. in Fl. Trop. Afr. **6**,1: 585 (1912) pro parte quoad specim. Kirk.——White, Dyer & Sloane, Succ. Euphorb. **2:** 882 (1941) pro parte quoad fig. 1005 et distrib. Zambesi.——Jacob. Handb. Succ. Pl.: 406 (1960) pro parte quoad distrib. Zambesi.

*Euphorbia nyikae* sensu Reynolds, Aloes Trop. Afr.: Pl. 37 (1966).

*E. breviarticulatae* Pax affinis sed planta altiore trunco centrali: ramorum segmentis plerumque oblongis longissimis; spinis plerumque brevioribus basin versus compressis; bracteis grandioribus; involucre lobis grandissimis forma dissimili; floribus masculis numerosioribus; stylis plus minusve duplo longioribus ad medium in columnam connatis bene distincta.

*Frutex* vel arbuscula, succulentus, spinosus, plerumque ad 4—5 m altus (interdum ad 10 m); trunco crasso; ramis patulis, saepe primo descendentibus, arcuato-ascendentibus, plerumque demum erectis, saepe truncum valde superantibus; rami inferiores interdum cadentes, planta tum habitu arbusculae. *Truncus* aliquantum segmentatus, initio 3-angulatus, mox 4—6-angulatus,

denique plus minusve cylindricus. *Rami* plus minusve verticillati, pauci ramosi, 3—4-alati (plerumque 3), valde in segmenta constricti, basi in stipitem lignosum plus minusve teretem angustati; *rami secundarii* ramulisque plerumque 3-alati, segmentorum basin versus ex marginibus alarum prodientes. *Segmenta* plerumque oblonga vel apicem versus gradatim leviter angustata, usque ad 32 cm longa (40 cm) × 20 cm lata, interdum late triangularia vel plus minusve late ovata; *alis* latissimis, tenuissimis, ramo centrum versus quam marginibus vix crassioribus; *margine* prominenter crenato-dentato, valde undato, corneo, continuo, primo rubro-brunneo, tandem cinerascenti, usque ad 2 mm crasso, in spinis et inflorescentiis lato facto; inflorescentia variabiliter posita, basi plerumque spinis binis (interdum 4) necnon saepe spinulis armata. *Folia* carnosa, plus minusve circularia vel ovata, acuta vel apiculata, recurva, c 3 mm longa, decidua cicatricibus obsolescentibus; marginibus lateralibus rubrobrunneis, textura podariis similibus, mox secedentibus, tandem spinulas formantibus. *Spinae* binae divergentes patentes, usque ad 1·5 cm longae, aliquantum compressae basin versus. *Inflorescentia* glabra, cymosa; cymis pedunculatis 1—5, fortuito-dispositis, unaquibusque cyathiis 3; *pedunculus* bibracteatus, plus minusve stipiformis, aliquantum lateraliter compressus, 4—5·5 mm diam., 7—12·5 (4) mm longus. *Bracteae* plus minusve ovatae, subacutae, 5·5—7 mm latae, 4—5·5 mm longae, carnosae, plerumque scissae. *Cymae* cyathio initio masculo sessili deciduo; cyathiis lateralibus bisexualibus; cymarum ramis 10—12 mm longis, basi c 4 mm diam., versus apicem paulo ampliatis compressisque; bracteis plus minusve late ovatis, saepe scissis, denticulatis, usque ad 7 mm latis, 5—6 mm longis, involucrum aequantibus vel hoc saepe paulo superantibus. *Involucrum* cyathiforme, 8—10 mm diam., c 6 mm longum; *glandulis* 5—6, transverse late ellipticis vel depresse obovatis, 4—5 mm latis, 2·75—3·5 mm longis, transverse, plicato-convexis marginibus transversis integris protentis valde uni-undatis; *lobis* 5—6, cuneato-obovatis, fimbriato-dentatis, interdum parum lobatis, aliquantum acute plicato-carinatis, c 2·5 mm longis, 1·75—2 mm latis. *Flores masculi* c 50, bracteolis filiformi-divisis numerosis, inaequaliter 5—6-fasciculati; bracteae fasciculares filiformi-laceratae, c 5 mm longae, ad 2 mm latae; pedicelli 4·5—6 mm longi; filamenta 1·5—1·75 mm longa. *Ovarium* subglobosum, perianthio lobato insidens, perianthii lobis inaequaliter longe attenuatis; partibus attenuatis in fructibus obsolescentibus; ovulum sub obturamento sub lobato minute denticulato cucculato parvulo dependens. *Styli*, c 4·5 mm longi, e basi in columnam crassam, obtuse trigonam, c 2 mm longam, 0·5 mm diam. connati; partibus libris patulis, intus leviter unicostatis, aliquantum canaliculatis versus apicem ampliatum breviter bifidum rugulosum. *Capsula* profunde trilobata, basi necnon apice truncata vel saepe apice aliquantum obtusa, 18—21 mm lata, c 8 mm alta, ex involucro exserta pedicello crasso, plus minusve cylindrico (plerumque aliquantum ampliato

basin versus), 7—8 mm longo, 3—3·5 mm diam. *Semen* subglobosum, c 3·5 mm diam., cremeum vel bubalinum, variabiliter maculosum, maculis flavidis, rubro-brunneis vel atro-purpureis.

The foregoing description was drawn up from *Leach & Wild* 11130 (flowering material) and *Leach* 9182 (fruiting material), both being collected from the same population and probably from the same individual.

Type: Moçambique, Manica e Sofala Distr., c 34° 17′ E: 19° 36′ S; *Leach & Wild* 11130 (K; LISC; PRE; SRGH, holo.).

Native name (Sena): "MUCONDE" (Torre & Paiva).

MOÇAMBIQUE. **N.** Moçambique Distr.: Lumbo, fl. 11.viii.1964, *Leach* 12371 (K; SRGH).

**Z.** Zambesia Distr.: between Mopeia and Campo, st. 12.ix.1944, *Mendonça* 2041 (LISC).

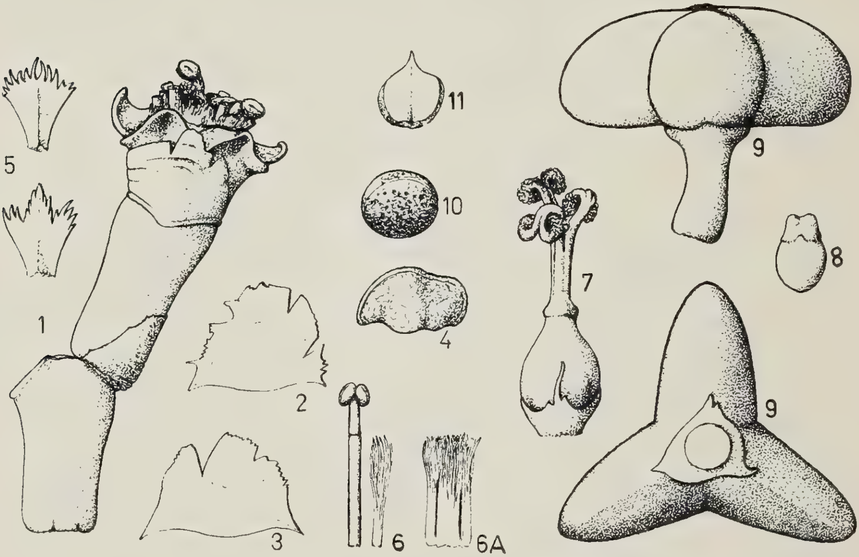


FIG. 10. **Euphorbia halipedicola** Leach.
(1) Portion of cyme (×3); (2) Bract (Cyme branch)—(×3); (3) Bract (Involucre)—(×3); (4) Gland—(×3); (5) Lobes—(×5); (6) Male flower and bracteole (×3); (6A) Fascicular bract—(×3); (7) Gynoecium—(×5); (8) Ovule—(×5); (9) Capsule—(×2); (10) Seed—(×3); (11) Leaf—(×3).

**MS.** Manica e Sofala Distr.: Lupata, lower Zambesi, fr. June 1859 *Kirk* (K); Shiramba, lower Zambesi, ic.361 del. *Kirk* 16.vi.1859 (K); Parque Nacional de Caçc, Gorongosa, fl. 30.iv.1964, *Torre & Paiva* 12315 (LISC); ibid. cult. Umtali, fr. 5.xi.1967, *Cannell* s.n. (SRGH); ibid. fl. 8.vii.1969, *Leach, Cannell & Tinley* 14253 (K; SRGH); near Lake Gambue, fr. 30.vi.1959, *Leach* 9182 (LISC; PRE; SRGH), idem, seedling cult. Greendale, *Leach* 9182A (SRGH), idem, cult. Nat. Bot. Gard. Salisbury, fl. & fr. May 1968 (K; SRGH); ibid. fl. 22.vi.1961, *Leach & Wild* 11130 (K; LISC; PRE; SRGH).

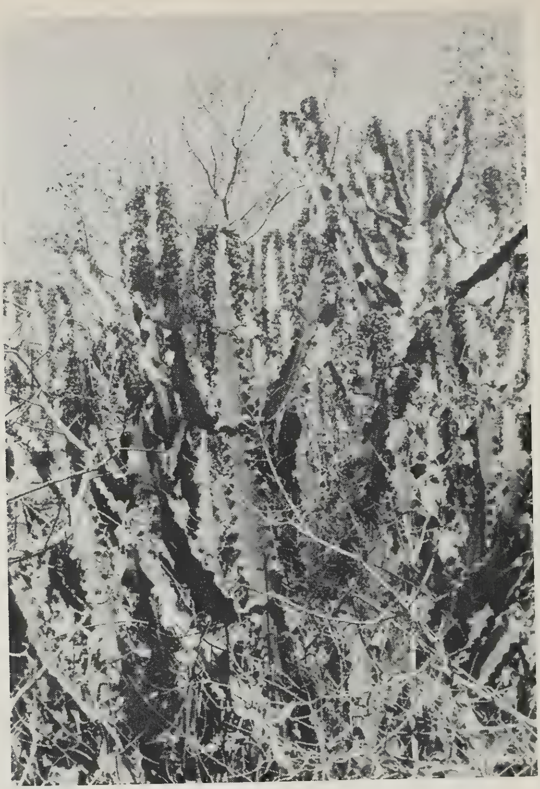
**SS.** Sul do Save Distr.: ± 10 mls. S of Mambone, st. 9.x.1963, *Leach & Bayliss* 11888 (LISC; PRE; SRGH); ibid. cult. Nelspruit, fl. & fr. 30.vii.1966, *Ambrose* s.n. in *Leach* 11728 (K; LISC; SRGH).

Note: *Torre* 5445 from Mocuba, Zambesia Distr., probably belongs here but the atypical segment shape and its habitat on a rock outcrop leave some room for doubt regarding its identification.

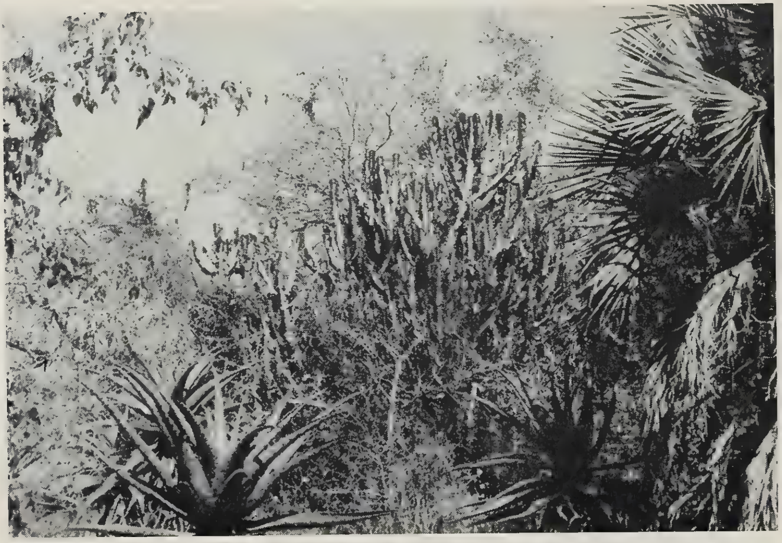
*E. halipedicola* is, in fact, probably most closely related to the plants abounding on the East African coast to the north of Dar-es-Salaam, but as there is considerable doubt regarding the identity of this population and the possibility of its hybrid origin cannot be disregarded, it has been considered advisable to base the diagnosis on the slightly less closely related but more definitely circumscribed *E. breviarticulata.*

From this latter the new species may be readily distinguished by its taller stature and stout central trunk, while the usually oblong, relatively long branch segments are quite distinct from those of *E. breviarticulata*, as are also the shorter spines which are somewhat compressed towards their base; the inflorescence with its larger bracts; much longer, differently shaped involucral lobes; more numerous male flowers and styles which are twice as long and united into a stout column for half their length, is also quite distinctive.

The Dar-es-Salaam population is so extremely variable in segmentation, spinescence, habit and stature, as well as in flowering and fruiting characters that it is thought quite possibly to be of hybrid origin. Some individuals and all the seedlings found, closely resemble those of the Moçambique populations, particularly in their oblong segments with characteristically wavy margins [clearly to be seen in the photograph of a plant on the Zambesi at Sena, in Reynolds, Aloes Trop. Afr.: t.37 (1966)]. However, it does seem that the Tanzanian plants have, as a general rule, smaller somewhat differently shaped capsules, while the small, subquadrate, shortly dentate involucral lobes of all the flowering material examined, are quite different from the most distinctive, fimbriate-toothed, cuneate lobes of the new species from the Flora Zambesiaca area.



Typical oblong segments with strongly wavy margins.



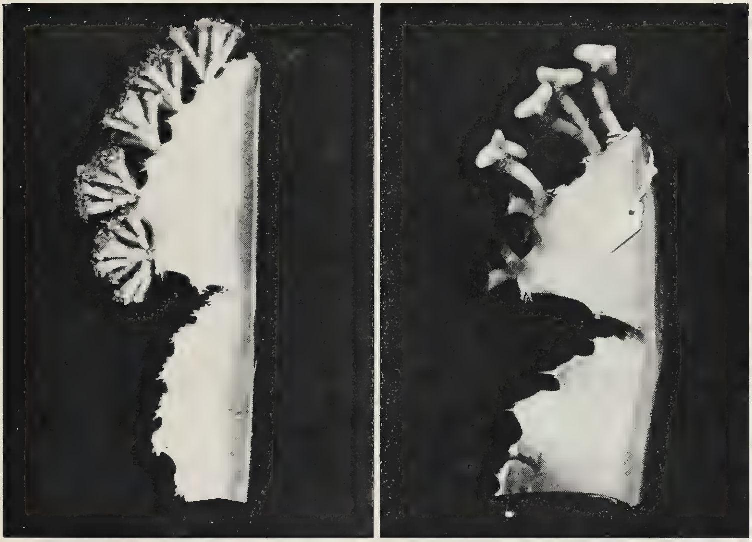
Plant ± 5 m high, at the type locality, near Lake Gambue, with *Aloe marlothii* Berger and *Hyphaene* sp.

FIG. 11. *Euphorbia halipedicola.*

The recorded distribution of the new species extends southward, on the low-lying coastal plain of Moçambique, usually in areas of seasonal or perennial vleis, generally in or at the margins of thickets and small patches of woodland, often in association with *E. lividiflora* Leach, *Aloe marlothii* Berger and *Hyphaene* sp., from Lumbo in the north to a few miles south of Mambone at the mouth of the Save River, in the Sul do Save District. Along the lower Zambesi there may be a slight distributional overlap with *E. cooperi* var. *calidicola*, but it is felt that the two taxa should scarcely be confused as they are so easily distinguished from each other by their respective segment shapes.

Plants appear to be most plentiful in the western portion of the Parque Nacional da Gorongosa, where large numbers are to be found, with some specimens up to 10 m tall and with the general aspect, from a distance, of large specimens of *E. cooperi*. Elsewhere colonies are less densely populated and appear to be of very scattered occurrence.

It was not possible, unfortunately, to locate any specimens of the new species in the vicinity of Kirk's localities (Chiramba and Lupata) although apparently eminently suitable habitats abounded, but it is thought that this is probably



Flowering segment with crowded, randomly arranged cymes *Leach & Wild* 11130.

Fruiting segment (some cymes removed) shewing deeply lobed capsules *Leach* 9182.

FIG. 12. *Euphorbia halipedicola*.

accounted for by the extensive shifting cultivation, particularly of cotton, which appears to have been effected all along the southern bank of the Zambesi.

*Plant:* a spiny, succulent shrub or small tree, usually up to 4—5 m high (sometimes up to 10 m), with a stout trunk and spreading, often at first descending, arcuate-ascending, usually finally erect branches, which often much exceed the central trunk; the lower branches sometimes falling, plants then assuming a more tree-like habit with a more or less rounded crown of branches. *Trunk* somewhat segmented, initially 3-angled, soon becoming 4—6-angled, more or less cylindric when plants become tree-like. *Branches* more or less whorled, sparingly rebranched, 3—4-winged (mostly 3), deeply constricted into segments, narrowed at the base into the stalk-like, more or less terete, central woody core; secondary branches and branchlets usually 3-winged, arising from the wing margins near the base of the segments. *Segments* mostly oblong or slightly tapering, up to 32 cm long (40 cm) × 20 cm broad, sometimes broadly triangular or more or less ovate; with broad, thin wings up to 2 mm thick at the prominently crenate-toothed, strongly undulate margins, which are scarcely thicker towards the small central core; with a narrow continuous horny margin, reddish brown at first, becoming whitish grey, broadening at the spine pairs and at the flowering eyes; flowering eye variable in position from shortly above to about half-way between the spine pairs, generally somewhat prominent and areole-like, usually armed with a pair (sometimes 4) of spreading, initially flattened spines up to 4 mm long and often with a number of prickles. *Leaves* more or less circular or ovate, acute or apiculate, recurved, c 3 mm long, fleshy, with red-brown lateral margins (of similar texture to that of the spine shields) which soon separate from the deciduous portion of the leaf and develop into the obsolescent prickles flanking the inconspicuous, depressed obovate or very shallowly obtriangular, obsolescent leaf scar. *Spines* in diverging spreading pairs, up to 15 mm long, longest at the widest part of the wings, usually somewhat compressed towards their base. *Inflorescence* glabrous, cymose, with 1—6 randomly arranged, pedunculate cymes of 3 cyathia; *peduncle* bibracteate, rather stalk-like, somewhat laterally compressed, 4—5·5 mm diam., 7—12·5 mm long (4 mm). *Bracts* subtending the cyme branches more or less broadly ovate, subacute, 5·5—7 mm wide, 4—5·5 mm long, fleshy, usually somewhat split and deteriorated. *Cymes* with the initial, sessile, central cyathium male, deciduous, and lateral bisexual cyathia borne on cyme branches 10—12 mm long, c 4 mm diam. at the base, becoming somewhat enlarged and laterally compressed towards the bibracteate apex. *Bracts* usually split, more or less broadly ovate, denticulate, up to 7 mm wide, 5—6 mm long, equalling or often exceeding the involucre. *Involucre* cup-shaped, 8—10 mm diam., c 6 mm long; *glands* 5—6, transversely broadly elliptic or depressed obovate, 4—5 mm wide, 2·75—3·5 mm long, with the transverse entire margins lengthened, and consequently somewhat wavy, the outer more than the inner and raised in a single central fold-like undulation so that the gland becomes rather sharply transversely convex; *lobes* 5—6, cuneate obovate, rather sharply plicate-keeled, fimbriate-toothed, often somewhat lobed, 2·5 mm long, 1·75—2 mm wide. *Male flowers* c 50, with numerous filiform-divided bracteoles, arranged in unequal fascicles (averaging 10 flowers each); each fascicle subtended by a filiform-laciniate internal bract c 5 mm long, up to 2 mm wide; *pedicels* 4·5 mm long; *filaments* 1·5—1·75 mm long. *Ovary* subglobose, seated on a lobed perianth with lobes of very unequal length (the attenuate portions of which become obsolete in fruit); *ovule* suspended under a somewhat two-lobed, minutely denticulate, hood-like obturator. *Styles* c 4·5 mm long, united at their base into an obtusely trigonous stout column c 2 mm long, 0·5 mm diam., the free portions somewhat ribbed down the inner face, becoming grooved towards the enlarged, shortly bifid, rugulose apices. *Capsule* deeply 3-lobed, 18—21 mm across the lobes, c 8 mm high, truncate at both base and apex, often somewhat rounded at the apex, exserted from the involucre on a more or less cylindric, stout pedicel (usually slightly enlarged towards the base), 7—8 mm long, 3—3·5 mm diam. with a fleshy somewhat 3-lobed perianth c 6 mm diam. *Seed* subglobose, c 3·5 mm diam., cream or buff-coloured, with rather variable, yellowish to dark reddish-brown or blackish purple mottling and speckling; suture slightly raised for rather more than half its length, dark brown.

### EUPHORBIA NYIKAE COMPLEX

**Euphorbia nyikae** Pax in Engl. Pfl. Ost-Afr. "C": 242 (1895).——No type cited.

The very brief description tells us that it is a 20 m tall tree; "ramis crassis (more Phyllocacti)" appears to be something of a contradiction, but it is thought that "crassis" may here mean overall diam. or width since it is followed by "plano-compressis" which together with the reference to Phyllocacti would appear to indicate flat thinly winged branches (N. E. Brown in Fl. Trop. Afr. notes that the type specimen of *E. nyikae*, presumably *Volkens* 51, is "flat and two-winged at the base and four-winged at the apex and the wings very thin"), and "podariis parvis" small, probably separate spine shields, while the cyathia are said to be arranged in 3 or fewer flowered dichasia.

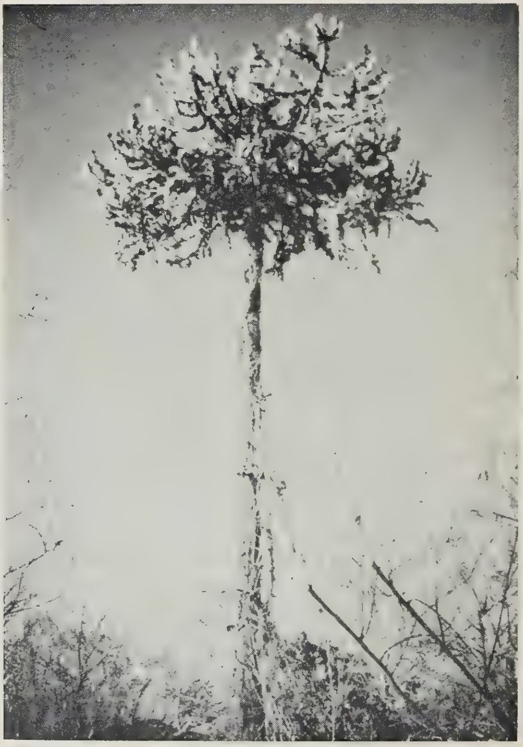
In Engl. Bot. Jahrb. **33**: 533 (1897) Pax cites *Volkens* 51 as the type and adds that the branches are up to 5 cm wide, the spines 6 mm long, the cyathia 6—7 mm diam. with small bracts and simple styles.

Finally in Engl. Bot. Jahrb. **34**: 73 (1905) again citing *Volkens* 51, he tells us that it is a 15 m tall tree, with branch segments 10—20 cm long and spines 1—1·5 cm long. There seems to be some discrepancy here when this is compared with his earlier descriptions.

The more comprehensive description provided by Volkens in Notizbl. Bot. Gart. Berl. appears to the writer unfortunately to include possibly more than one species, or at least to be based on specimens differing from those of Pax's two earlier descriptions, and also perhaps to have provided the basis, at least in part, for Pax's third, somewhat different description.

In addition to the apparent discrepancies between the various descriptions there seems also to be some doubt regarding the localities involved.

The confusion surrounding this species and others from East Africa seems to have persisted down to the present day; no two authors seeming to be in complete agreement regarding either identities or synonymy. There are certainly several species involved, some being quite distinct from each other in their widely differing floral characters.



Plant ± 10 m high, at the type locality, Kibwezi, Kenya, *Leach & Bayliss* 10242.
FIG. 13. *Euphorbia kibwezensis.*